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NATIONAL DAM INSPECTION PROGRAM. REFUSE SETTLING BASIN (NDI NUM--ETC(U)

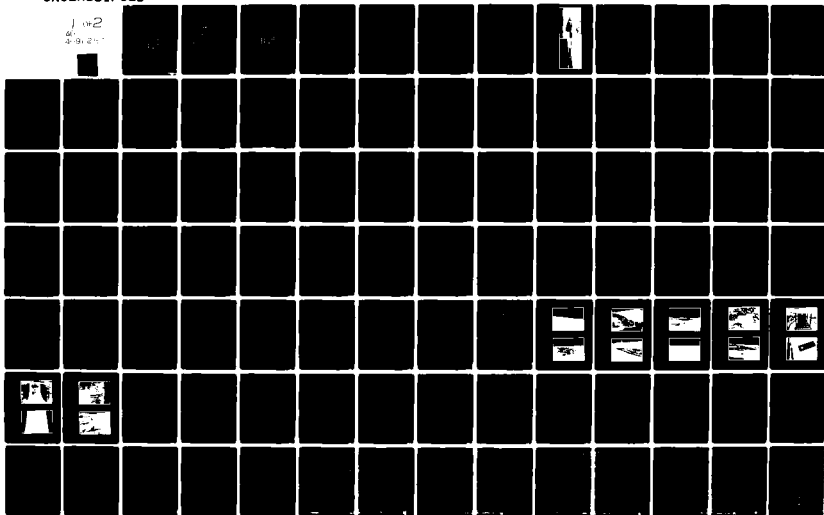
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OHIO RIVER BASIN
SAWMILL CREEK
WASHINGTON COUNTY

PENNSYLVANIA

NDI No. PA 00908
PENN DER No. 63-78

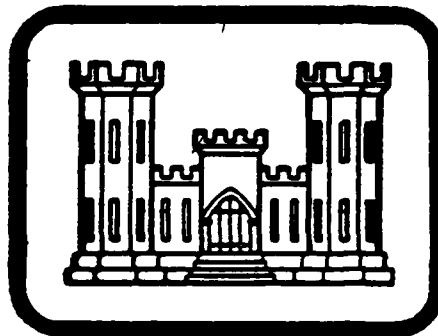
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REFUSE SETTLING BASIN

UNITED STATES STEEL CORPORATION
RAW MATERIALS DIVISION

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



PREPARED FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND 21203

BY

DACW 31-80-C-0026
ACKENHEIL & ASSOCIATES GEO SYSTEMS, INC.
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SEPTEMBER 1980

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~~OHIO RIVER BASIN~~

National Dam Inspection Program.

REFUSE SETTLING BASIN

~~WASHINGTON COUNTY, COMMONWEALTH OF PENNSYLVANIA~~

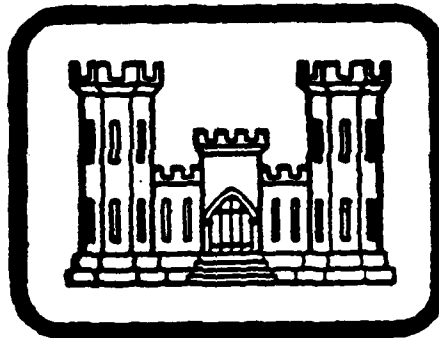
(NDI Number ~~NDI-PA 00908~~,

PennDER ~~NO. 63-78~~ Number 63-78)

Ohio River Basin, Sawmill Creek,
Washington County, Pennsylvania.

~~UNITED STATES STEEL CORPORATION~~

PHASE I INSPECTION REPORT.
~~NATIONAL DAM INSPECTION PROGRAM~~



DTIC
NOV 5 1980

Prepared for: DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

Prepared by: ACKENHEIL & ASSOCIATES GEO SYSTEMS, INC.
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15/DACW31-80-C-0026

Date:

11 September 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, materials testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some time in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" (PMF) for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS

NAME OF DAM: Refuse Settling Basin
STATE LOCATION: Pennsylvania
COUNTY LOCATION: Washington
STREAM: Unnamed tributary to
Sawmill Creek.
DATE OF INSPECTION: 5 May 1980
COORDINATES: Lat. 40°11'30",
Long. 80°00'24"

ASSESSMENT

Based on a review of available design information and visual observations of conditions as they existed on the date of the field inspection, the general condition of the Refuse Settling Basin is considered to be fair.

This assessment is based on visual observations that indicate a possible inadequate margin of safety against slope failure if a high ground water level exists in Embankment A. The condition is not considered to represent an immediate threat to the structure because of the relatively low impoundment pool elevation. It should, however, be evaluated. If a high ground water does not exist in Embankment A, the facility can be considered to be in good condition.

The structure is classified as an "intermediate" size, "high" hazard dam. Corps of Engineers guidelines recommend the Probable Maximum Flood (PMF) as the Spillway Design Flood for an "intermediate" size, "high" hazard dam. The Refuse Settling Basin's Spillway Design Flood is the Probable Maximum Flood. Spillway capacity is "adequate" because the non-overtopping flood discharge was found, by using the HEC-1 computer program, to be in excess of 100 percent of the PMF.

The visual inspection indicated several minor deficiencies in addition to the possible high ground water condition. The deficiencies can be corrected or improved through implementation of the following recommended evaluation, remedial, monitoring and/or maintenance efforts.

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SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS (CONT'D)
Refuse Settling Basin

RECOMMENDATIONS

1. Additional Investigations: It is recommended that the owner immediately retain the services of a registered professional engineer knowledgeable and experienced in the design and construction of earth dams to provide an evaluation of the stability of Embankment A. This evaluation should include but not be limited to the following:

- a. Review and evaluation of monitoring instrument data.
- b. Investigation of the swampy conditions at and below the toe of the embankment.
- c. Stability calculations, if necessary.

2. Emergency Operation and Warning Plan: Concurrent with the additional investigations recommended above, the owner should develop an Emergency Operation and Warning Plan including:

- a. Guidelines for evaluating inflow during periods of heavy precipitation or runoff.
- b. Procedures for around the clock surveillance during periods of heavy precipitation or runoff.
- c. Procedures for drawdown of the reservoir under emergency conditions.
- d. Procedures for notifying downstream residents and public officials, in case evacuation of downstream areas is necessary.

3. Remedial Work. The Phase I Inspection of the Refuse Settling Basin also disclosed several other deficiencies which should be corrected during routine maintenance.

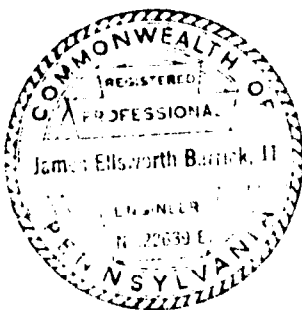
- a. Repair minor sloughing and minor erosion and backfill animal burrows observed on and adjacent to Embankment A.
- b. Repair minor erosion observed adjacent to the underflow pipes inlet structure.

SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS (CONT'D)
Refuse Settling Basin

- c. Mow dense vegetation on the upstream and downstream slopes.
- d. Carefully inspect upstream and downstream slopes and backfill all animal burrows and eroded areas.
- e. Clean road drain catch basins and regrade the surface as necessary to promote proper drainage in the left groin.
- f. Repair the eroded areas below the road drain outlet structure and provide an adequate erosion resistant drainage channel.
- g. Repair the eroded area below the Pond Drain 2 outlet and provide an adequate erosion resistant channel.
- h. Replace the eroded backfill behind the emergency spillway chute's right wall and modify surface drainage patterns to assure the integrity of the replaced backfill.
- i. Clean vegetal growth and debris from the emergency spillway chute.

Samuel G. Mazzella 12 Sept 88
Samuel G. Mazzella Date
Project Engineer

James P. Hannan 12 September 1988
James P. Hannan Date
Project Engineer



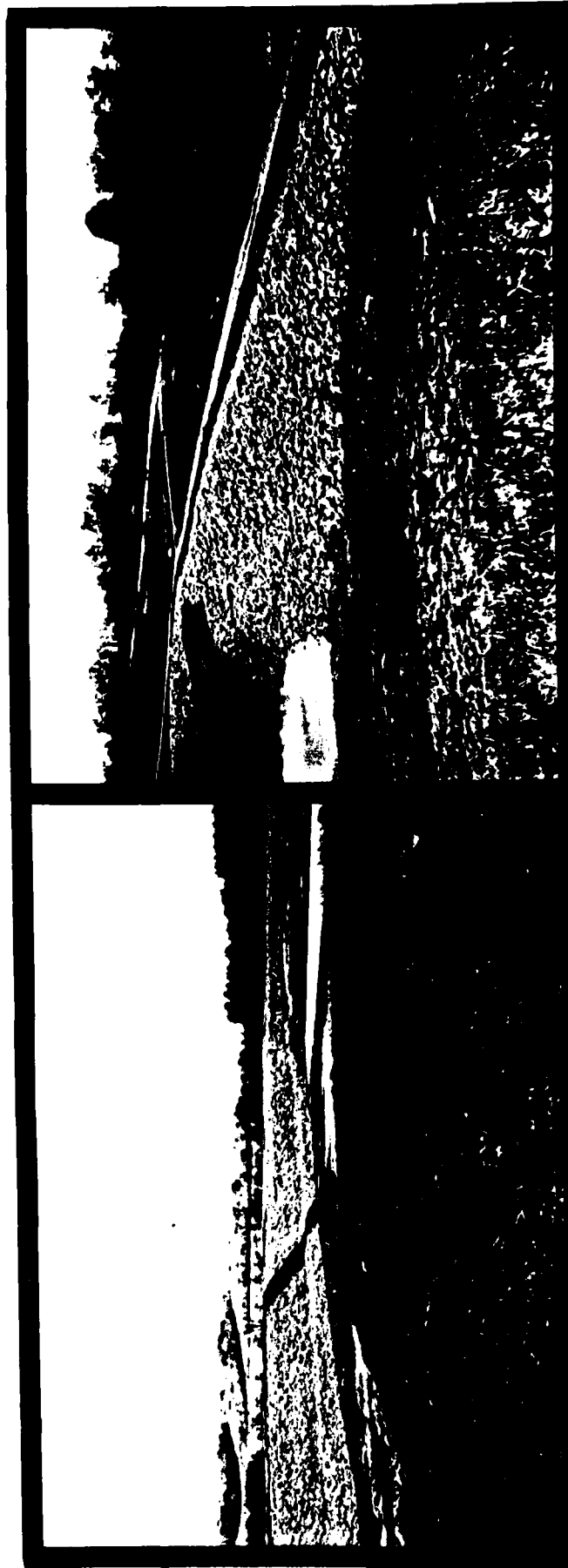
James E. Barrick 12 Sept 1988
James E. Barrick, P.E. Date
PA Registration No. 022639-E

Approved by:

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date

REFUSE SETTLING BASIN



EMBANKMENT A

EMBANKMENT B

OVERVIEWS

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
FINAL REPORT
NATIONAL I. I. NO. PA 00908
PennDER No. 63-76

SECTION I
PROJECT INFORMATION

1.1 GENERAL

a. Authority: The Phase I investigation was performed pursuant to authority granted by Public Law 92-367 (National Dam Inspection Act) to the Secretary of the Army, the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose: The purpose of the investigation is to make a determination on whether or not the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. General: The Refuse Settling Basin consists of two earth and rockfill (coarse coal refuse) embankments across an unnamed tributary to Sawmill Creek in Fallowfield Township, Washington County, Pennsylvania. The impoundment created by the two dams is utilized to store fine coal refuse slurry from the coal preparation plant of the United States Steel Corporation's Maple Creek Mine complex.

(1) Embankment A: Embankment A was designed and constructed as a zoned structure consisting of a clay core, a random earth upstream shell and a coarse coal refuse downstream shell. The core traverses the centerline and extends to bedrock in a cutoff trench. The foundation rock was pressure grouted prior to embankment construction. The embankment is 2600 feet long with a toe to crest height of 91.0 feet and a crest width of 30 feet. The embankment upstream slope ranges from 1.8V:1H to 2H:1V. The downstream slope has 2 benches, 10 feet wide and intermediate slopes of 2.3H:1V. Near the downstream toe, the slopes range from 3.3H:1V to approximately 1H:1V.

(2) Embankment B: Embankment B was designed in the same manner as Embankment A and is 1143 feet long with a toe to crest height of 37.8 feet. The crest is 30 feet wide. The upstream slope was observed to be 2H:1V and the downstream face has one bench 10 feet wide and a slope of 2.6H:1V.

(3) Principal Spillway: The principal spillway consists of a 20 inch diameter (nominal) steel conduit that connects an intake structure at the rear of the reservoir with an outlet structure below the downstream toe of Embankment A.

The intake structure consists of numerous 90°, 18 inch diameter steel elbows welded to the conduit. These inlet ports are positioned in such a way that reservoir outlet control can be maintained as the bottom of the reservoir rises due to the deposition of fine coal refuse materials.

The outlet structure lies at the toe of the Embankment A and consists of a reinforced concrete valve house that contains a 20 inch gate valve and a sharp-crested weir flow measuring device.

(4) Underflow Pipes: The watershed that lies up-valley of Embankment B is drained by two 20 inch diameter (nominal) steel pipes that pass beneath the reservoir and both embankments. The pipes have identical intake and outlet structures which are constructed of reinforced concrete and have trash cages.

(5) Emergency Spillway: The emergency spillway is an open channel cut into natural earth on the left abutment of Embankment A. The channel bottom is 15 feet wide with 1.5H:1V side slopes. The channel is riprap lined for approximately 530 feet.

(6) Downstream Conditions: The unnamed tributary to Sawmill Creek below the Refuse Settling Basin passes through a relatively narrow, steep sided valley. Approximately 300 feet below the toe of Embankment A, the stream channel parallels the downstream toe of the Treated Water Pond's embankment. Beyond the Treated Water Pond, the stream parallels State Route 917 until its confluence with Sawmill Run, two miles below Embankment A. Approximately 2.7 miles below Embankment A, Sawmill Creek flows into Pigeon Creek, which ultimately flows into the Monongahela River near Monongahela, Pennsylvania.

(7) Reservoir: The Refuse Settling Basin reservoir was about 1700 feet long at the time of the inspection. When the reservoir level is at the crest of the emergency spillway, the pool will be 1940 feet long. When the reservoir level is at the crest of the embankment, the pool will be 1960 feet long.

(8) Watershed: The watershed contributing to the Refuse Settling Basin is completely grassed. The portion above Embankment B is diverted past the Refuse Settling Basin by the underflow pipes. The reservoir comprises approximately one third of the watershed.

b. Location: The Refuse Settling Basin is located in Fallowfield Township, Washington County, Pennsylvania, approximately 4 miles west of Monongahela, Pennsylvania.

c. Size Classifications: Embankment A has a maximum toe to crest height of 91 feet. Embankment B has a maximum toe to crest height of 37.8 feet. The maximum storage capacity impounded by the two embankments is 1923 acre-feet. Based on this data, the Refuse Settling Basin is classified as an "intermediate" size structure.

d. Hazard Classification: The Refuse Settling Basin is classified as a "high" hazard dam. In the event of a dam failure, at least 8 inhabited dwellings, a coal mine portal and load out facility, State Route 917, and the Treated Water Pond could be subjected to substantial damage and loss of life could result.

e. Ownership: The Refuse Settling Basin is owned by the United States Steel Corporation, Raw Materials Division, Uniontown, Pennsylvania. Inquiries concerning the dam should be addressed to:

United States Steel Corporation
Raw Materials Division
Frick District
5th Floor, Fayette Bank Building
Uniontown, Pennsylvania 15401
Attention: Mr. Robert Witt, Jr., Chief Engineer
(412) 438-3511 Ext. 256

f. Purpose of Dam: The Refuse Settling Basin was constructed as a storage facility for fine coal refuse slurry produced at the Maple Creek Mine coal preparation plant.

g. Design and Construction History: Design drawings were prepared by L. Robert Kimball and Associates of Ebensburg, Pennsylvania in 1975. A permit to construct two earthen dams across an unnamed tributary to Sawmill

Creek was applied for on 18 June 1974 and approved by the Department of Environmental Resources on 7 July 1975. The dams and appurtenant structures were constructed by the Trumbull Corporation of Pittsburgh, Pennsylvania between July 1975 and November 1978.

h. Normal Operating Procedures: The Refuse Settling Basin was designed to operate as an uncontrolled structure. Under normal operating conditions, fine coal refuse slurry is pumped from the preparation plant and is discharged onto the upstream slope of Embankment A. Pool level is maintained by the principal spillway structure located on the west side of the Basin between Embankments A and B. The emergency spillway crest is at Elevation 1155.0 to accommodate flows from a PMP type storm when the reservoir pool elevation is at the spillway crest.

1.3 PERTINENT DATA

- | | | |
|----|---|--------------|
| a. | <u>Drainage Area:</u> | 0.17 sq. mi. |
| b. | <u>Discharge at Dam Facility</u> | |
| | Maximum Flood at Dam Facility | Unknown |
| | Principal Spillway Capacity
at Top of Embankment A | 309 cfs |
| c. | <u>Elevation (feet above MSL)</u> | |
| | Design Top of Embankment A | 1158.0* |
| | Current Top of Embankment A
(low point) | 1158.1 |
| | Emergency Spillway Overflow Crest | 1155.0* |
| | Pool at Date of Inspection | 1124.9 |
| | Inlet Invert of Principal Spillway | Varies |
| | Outlet Invert of Principal Spillway | 1067.1 |
| | Maximum Tailwater | Unknown |
| d. | <u>Reservoir Length</u> | |
| | Length of Maximum Pool | 1960 feet |
| | Length of Pool at Emergency
Spillway Crest | 1940 feet |
| | Length of Pool at Time of
Inspection | 1700 feet |

e. Reservoir Storage

Current Top of Embankment A	1923 acre-feet
Emergency Spillway Crest	1800 acre-feet*

f. Reservoir Surface

Current Top of Embankment A	41.8 acres
Emergency Spillway Crest	38.4 acres*

g. Embankment A

Type	Zoned Earth and Coarse Coal Refuse
Length	2600 feet
Height	91 feet
Crest Width	30 feet
Slopes	
Downstream	2.3H:1V to 3.3H:1V
Upstream	1.8H:1V to 2.0H:1V
Impervious Core	Yes*
Grout Curtain	Yes*

h. Embankment B

Type	Zoned Earth and Coarse Coal Refuse
Length	1143 feet
Height	37.8 feet
Crest Width	30 feet
Slopes	
Downstream	2.6H:1V
Upstream	1.6H:1V to 2.0H:1V
Impervious Core	Yes*
Grout Curtain	Yes*

i. Principal Spillway (Regulating Outlet)

Type	20 inch Diameter (Nominal) Steel Pipe with Intake Ports at Various Levels
Crest Elevation	Varies
Gate Valve	Yes, at downstream toe of Embankment A
Conduit Length	1230 feet*
Upstream Flow Control	Yes
Anti-seep Collars	Yes*

j. Emergency Spillway

Type	Trapezoidal Open Channel
Length of Crest	15 feet
Side Slopes	1.5H:1V
Crest Elevation	1155.0
Approach Channel Slope	-3%
Discharge Channel Slope	3%

k. Underflow Pipes

Type	Two 20 inch Diameter (Nominal) Steel Pipe with inlet at upstream toe of Embankment B
Conduit Lengths	2000 feet
Gate Valve	No
Anti-seep Collars	Yes, 20*

*Taken or derived from design drawings.

SECTION 2 ENGINEERING DATA

2.1 DESIGN

a. Design History: The initial Refuse Settling Basin design was prepared by the owner's engineering personnel and a Dams and Encroachments Permit was applied for in 1974. PennDER withheld the permit until a complete soils and foundation investigation was performed by a competent soils engineering firm. This investigation was completed in 1975 and the permit was approved on 7 July 1975.

b. Data Available: Data available for review included:

(1) The contents of PennDER files consisting of correspondence with owner's representatives and state personnel, portions of the owner's original permit application, two state reports on the proposed design, and state and owner's construction progress reports.

(2) Design drawings prepared by L. Robert Kimball that were provided by United States Steel Corporation for review and reproduction.

(3) Discussions with a company representative during the performance of the Refuse Settling Basin site inspection.

2.2 CONSTRUCTION

a. Constructor: The dam was constructed between July 1975 and November 1978 by Trumbull Corporation of Pittsburgh, Pennsylvania.

b. Modification: There are no reported modifications to the structure after its completion.

2.3 OPERATION

a. Dams: The dams were designed to operate without a dam tender and no operational data is available.

Monitoring instrumentation is reportedly maintained and records of readings are reportedly on file with the Maple Creek Mine Manager. Written permission of the

United States Steel Corporation is needed to review these records. Such permission was requested but had not been received at the time of preparation of this report.

b. Principal Spillway: The principal spillway requires periodic attention because of the constantly rising level of fine coal refuse in the impoundment. As the refuse rises, successive inlet ports of the principal spillway intake structure are sealed off. Consequently, only a small amount of free water is impounded at any given time. The inlet ports are sealed when there is insufficient free water to produce adequate settling of coal refuse fines.

c. Emergency Spillway: The emergency spillway is an uncontrolled, open channel on the left abutment of Embankment A. It does not require the attention of operating personnel and needs only periodic maintenance.

d. Underflow Pipes: The underflow pipes are uncontrolled and require only periodic maintenance.

2.4 EVALUATION

a. Availability: Available information was obtained from the Pennsylvania Department of Environmental Resources and was supplemented by drawings received from and conversations with a representative of United States Steel Corporation, the Owner.

b. Adequacy: The available design information supplemented by field inspection and supporting engineering analyses presented in succeeding sections is adequate for the purposes of this Phase I Inspection Report.

c. Validity: Based on the available data, there appears to be no reason to question the validity of the available design information and drawings.

SECTION 3
VISUAL INSPECTION

3.1 FINDINGS

a. General: The field inspection of the Refuse Settling Basin was performed on 5 May 1980, and consisted of:

(1) Visual observations of the embankment crest and slopes, groins and abutments;

(2) Visual observations of the principal and emergency spillways including intake structures, outlet structures, and approach and discharge channels;

(3) Visual observations of the embankments' downstream toe areas including drainage channels, hydraulic structures, and surficial conditions;

(4) Visual observations of the underflow pipes inlet and outlet structures;

(5) Visual observations of downstream conditions and evaluation of the downstream hazard potential.

(6) Visual observations of the reservoir shoreline and watershed;

(6) Transit stadia surveys of relative elevations along the embankment crest centerlines, spillways, and across the embankment slopes.

The visual observations were made during periods when the reservoir and tailwater were at normal operating levels.

The visual observations checklist, field plan, profiles and sections containing the observations and comments of the field inspection team are contained in Appendix A. Specific observations are illustrated on photographs in Appendix C. Detailed findings of the field inspection are presented in the following sections.

b. Embankment A:

(1) Crest: The crest of Embankment A was observed to have the proper alignment and was generally level throughout its length. The access road crossing

the crest had a uniform gravel covering and the shoulders were vegetated with dense grass. Minor drying cracks were observed at several locations on the embankment crest. The crest was measured to be 30 feet wide and 2600 feet long including curved sections at both ends of the embankment.

(2) Upstream Slope: The upstream slope of the embankment had a uniform covering of sandstone riprap. The riprap materials ranged in size from 2 inches to 20 inches and were uniformly placed across the slope. No erosional gullies or scarps were observed. The upstream slope ranged from 1.8H:1V to 2H:1V with a 27 foot wide bench at about mid-height. The groin area between the riprap and the unsubmerged portion of the slope was in good condition along the entire upstream toe.

(3) Downstream Slope: The downstream slope of Embankment A was observed to be generally uniform and covered with a thick stand of grass. The slope appeared to be maintained as no high brush or trees were observed.

The slope between the first and second bench on the downstream face contained numerous tension cracks and scarps resulting from the apparent surficial slumping of the embankment's topsoil cover. Also, several animal burrows were noted in this particular area only.

Numerous strips of differing vegetation were noted, particularly below the first bench of the downstream slope. The vegetation in these areas was generally greener and less dense than other slope vegetation. The U.S.S representative indicated that considerable maintenance work had been done on the downstream slope to repair sloughs and small slumps of topsoil material. These strips appear to be the result of that maintenance effort.

Two wheel ruts were noted on the first bench near the left end of the embankment. The wheel ruts appeared to have impounded water in the recent past.

The lower embankment slope area which lies below the second bench, consists of both grass and rockfill covered slopes, with the rockfill located in the lower reaches of the embankment along the embankment groin. The grassed areas were in good condition with no slumping or cracks observed. The rock covering was observed to be somewhat less than uniform with outcrops of coal refuse noted at various locations. No serious erosion was occurring in this area.

A small slump of material was observed immediately behind the headwall for the underflow pipes outlet structure. The slump did not appear to threaten the structure headwall but continued movement could endanger the underflow pipes. In, general, the slopes of the lower toe area are somewhat steeper than the upper embankment slopes.

c. Embankment A Groins:

(1) Right: The right groin of Embankment A was observed to be in excellent condition for its entire length. The upper portion of the groin consists of a rock lined channel immediately to the right of the access road. This groin was designed to carry flow from the diversion ditch that parallels the access road around the upper end of the reservoir. No significant erosion was observed but some minor displacement of riprap material was noted.

The lower groin along the downstream toe of Embankment A consisted of a uniformly gravel covered roadway with a small side drainage ditch. No significant erosion, seepage or other deterioration was observed in this groin.

(2) Left: The left groin was observed to be densely covered with grass throughout its entire length along the left side of Embankment A. No serious erosion, seepage, or other deterioration of the junction of the embankment and abutment was observed.

d. Embankment A Abutments:

(1) Right: The right abutment along the upper portion of the embankment was observed to be quite flat and generally tree covered. No indications of seepage or instability were observed on the abutment. The lower abutment below the main portion of the dam was generally grass covered and in good condition. Again, no seepage or slope instability was observed.

(2) Left: The left abutment consists generally of a flat area beyond the embankment containing the riprap lined emergency spillway. The area was covered with a uniform stand of dense grass and was observed to be in good condition. No instability and no seepage were observed anywhere on the left abutment.

(3) Downstream Toe Area: The downstream toe area was observed to be in good condition on the right side where the access road approaches the principal spillway outlet structure.

On the left, the abutment drops into a valley which is generally swampy and contains considerable water related vegetation. Also, some softness in the toe area was observed immediately below the slump of the rockfill toe area described earlier.

The swampy areas were generally soft and contained standing water, but no moving water was observed.

No silt deposits or indications of large seepage flows from beneath the embankment were observed anywhere in the downstream toe area.

e. Embankment B:

(1) Crest: The crest of Embankment B was observed to be generally straight and slightly higher in the central portion of the embankment than at either end. The stadia survey indicated that the embankment had a minimum crest elevation of 1155.8. This low elevation may have been the result of using an inaccurate benchmark (the concrete apron of the underflow pipe inlet structure) or may indicate an actual low crest condition.

The access road across the crest was uniformly gravel covered and the shoulders were covered with dense grass. Minor drying cracks were observed on the crest.

(2) Upstream Slope: The upstream slope of the embankment was entirely covered with a uniform layer of riprap material. The riprap stone size was observed to range from two inches to 24 inches. The covering was relatively thick and no erosional gullies or scarps were observed. The junction between the upstream slope and the unfilled portions of the reservoir was observed to be in good condition with only minor erosion near the toe of the embankment.

(3) Downstream Slope: The downstream slope of Embankment B was observed to be generally uniform over its entire length and was covered with a dense stand of grass. No cracks, scarps or bulges were observed on the downstream slope. The toe of the slope was protected with riprap to a height of approximately 5 feet. Both groins of the embankment were in excellent condition with only minor erosion observed due to surface water runoff. Remnants of hay bail sediment control check dams were noted in both groins and their associated growth of dense grass was continuing to provide erosion protection.

The underflow pipes inlet structure lies at the toe of the embankment. A small flow from the watershed above Embankment B was flowing into the underflow pipes.

Minor erosion has occurred in the riprap adjacent to the underflow pipes inlet structure. The erosion appears to be the result of surface runoff in the groin.

(4) Abutments: The abutments were observed to be mildly sloped and grassed covered. No indications of instability or seepage were observed in the immediate vicinity of the dam.

A 6 inch diameter asphalt coated CMP was discharging a trickle flow to the underflow pipes inlet channel, immediately above the toe of the embankment. The drain pipe appeared to be coming from the left abutment area.

f. Principal Spillway:

(1) Conduit: The principal spillway conduit is a 20 inch diameter (nominal) steel pipe that connects an intake structure located in the upper portion of the reservoir with an outlet structure below the toe of Embankment A.

(2) Intake Structure: The intake structure lies on a back slope of the reservoir and consists of numerous 18 inch diameter steel pipe elbows (90°) welded to the principal spillway conduit in such a way that reservoir outlet control can be maintained as the bottom of the reservoir rises due to deposition of fine coal refuse materials. The conduit has been founded on a relatively steep slope of the reservoir and the inlet ports are located in pairs on each side of the conduit. Access to the inlet ports is via a steel staircase placed over top of the conduit. Each inlet port contains a steel plate cover that was loosely held in an open position by one bolt.

As the sediment level in the reservoir rises such that the quality of the outflowing water becomes inadequate, the lower most pair of inlet ports are covered with the steel plates and sealed off. The water level consequently rises to the next pair of ports, which provide for reservoir level maintenance and outflow of water. Two moveable steel baskets are placed over the active inlet ports to provide for containment of trash, debris and scum.

(3) Outlet Structure: The outlet structure for the principal spillway lies at the toe of Embankment A and consists of a reinforced concrete valve house that contains a 20 inch diameter gate valve for the conduit. Immediately below is a second concrete structure that contains the conduit outlet which consists of a 20 inch diameter, 90° elbow turned vertically so that the flow rises into the outlet structure. Flow is then directed downstream through a stilling area and over a rectangular, sharp-crested weir near the end of the outlet structure box. Flows are then discharged to a riprapped area at the upper end of the discharge channel.

(4) Outlet Channel: The discharge channel for the principal spillway and for surface drainage below Embankment A consists of a stilling pool area and an excavated earth channel running diagonally away from the toe of the dam.

The stilling pool area was observed to be partially silted.

The discharge channel was observed to be straight and of generally uniform slope. Some small brush and trees were noted along the shoreline below the dam. The channel appeared to be capable of handling discharge flows from the outlet structure as well as flows that enter along the toe of the embankment. These flows would include surface runoff from precipitation events and discharge from the emergency spillways of both the Refuse Settling Basin and the adjacent Treated Water Pond.

g. Emergency Spillway:

(1) Approach Channel: The approach channel to the emergency spillway was observed to be free of debris and obstructions that would hinder flows from reaching the overflow crest.

(2) Overflow Crest: The overflow crest of the emergency spillway is a broadcrested weir at the centerline of the embankment. The spillway was lined with riprap in this vicinity and no erosion or collapse of riprap was observed that might impair the discharge capacity. The weir crest was measured to be 15 feet long and 30 feet wide. The Embankment A crest access road crosses the spillway at the overflow crest.

(3) Discharge Channel: Emergency spillway discharge is carried by a riprap lined, open channel that leaves the broadcrested weir area, turns 90° and

passes down the left abutment. Near the valley bottom, the channel turns 90° to the right and approaches the slurry pipeline facility. Here, the riprap lining ends and the channel discharges into the natural valley bottom below the embankment groin. Discharge is then carried across the valley bottom to the stilling pool area at the toe of Embankment A.

The discharge channel was approximately 4 feet deep and 15 feet wide with riprap lining at least two feet up the sides. Some minor erosion of side slopes was observed but no sloughing or conditions that would obstruct flow in the channel were noted.

h. Underflow Pipes:

(1) Intake Structure: The intake structure for surface drainage from the watershed above Embankment B consists of a concrete headwall containing two 20 inch diameter steel pipes. The intake structure includes an approach slab with wingwalls and is covered with a steel grate trash cage. On the date of inspection, flow into the pipes was unobstructed.

(2) Outlet Structure: A similar type concrete structure with steel grate has been constructed at the downstream toe of Embankment A immediately to the left of the principal spillway outlet structure. The underflow pipes outlet was observed to be functioning properly. Discharge from the outlet is to the stilling pool area below the downstream toe of Embankment A.

i. Instrumentation:

Standpipes, piezometers, slope and settlement indicators were installed in both embankments for performance monitoring purposes. The U.S.S. representative stated that the data obtained from periodic readings of the instruments was maintained at the Maple Creek Mine Manager's office but that written permission to review the data was required.

j. Reservoir:

(1) Slopes: The reservoir slopes, both above and below the crest elevation of the embankments, were observed to be flat to moderately steep and were entirely grass covered and well maintained. Local evidences of minor sloughing were observed both above and below the crest at locations where slopes were generally steeper.

Considerable sloughing was observed in the upper watershed along the diversion channel. Some blockage of the channel was observed.

(2) Sedimentation: The reservoir is designed to impound fine coal refuse slurry materials from the Maple Creek Mine preparation plant. Consequently, sedimentation of the reservoir is progressing at a relatively constant rate. The coal refuse slurry is discharged to the reservoir from two steel pipes that outlet at the crest of Embankment A. The slurry then runs over the riprap covering on the upstream slope to the impoundment below.

(3) Watershed: The watershed was observed to be almost entirely grass covered and was quite small, as the impoundment facility has been constructed near the crest of a hill.

k. Downstream Conditions:

(1) Downstream Channel: The discharge channel that provides an outlet for flows from the principal and emergency spillways, the underflow pipes, and surface drainage, was straight and generally unobstructed for about 1000 feet below the toe of Embankment A. At that point, the channel joins the original creek channel below the toe of the adjacent Treated Water Pond.

Below this point, the creek parallels Ginger Hill Road (State Route 917) for about 1.5 miles until it empties into Sawmill Creek.

(2) Floodplain Development: Visual inspection of the floodplain of the unnamed tributary to Sawmill Creek, revealed eight inhabited dwellings, a mine portal and a loadout facility in the two mile reach immediately below the Refuse Settling Basin.

3.2 EVALUATION

The following evaluations are based on the results of the visual inspections performed on 6 May 1980.

a. Embankment A: The condition of Embankment A is considered to be fair. This evaluation is based on observations that indicated the possibility of a high ground water level in the embankment.

The deficiencies observed included:

- (1) Considerable surficial sloughing of embankment slopes.
- (2) Animal burrows.
- (3) A slough zone in the vicinity of the underflow pipes outlet structure.
- (4) Swampy areas below the toe of the embankment.
- (5) Minor erosion of downstream slopes.
- (6) Wheel ruts on one bench.

b. Embankment B: The condition of Embankment B is considered to be good. While no serious deficiencies were observed, two conditions were noted that should be investigated or repaired. They are:

- (1) A possible low crest condition.
- (2) Minor erosion beneath the riprap at the downstream toe of the embankment.

c. Principal Spillway: The principal spillway including exposed pipe and concrete surfaces were observed to be functional and in excellent condition.

d. Emergency Spillway: The emergency spillway was observed to be functional and in very good condition. Some minor erosion of discharge channel slopes was noted.

e. Underflow Pipes: The underflow pipes were observed to be functional and in excellent condition.

f. Reservoir Area: Some sloughing of diversion channel slopes was noted in the upper reservoir area, to the extent that diversion channel flows might be impeded.

g. Stilling Pool Area: Some silting of the stilling pool area at the toe of Embankment A was noted. The origin of the sediments could not be observed but was felt to be the result of surface runoff from adjacent embankment and abutment areas.

h. Hazard Potential: Based on the observed height of the embankment and downstream floodplain conditions, the Refuse Stilling Basin was assigned a "high" hazard potential rating.

SECTION 4 OPERATIONAL FEATURES

4.1 PROCEDURE

Reservoir pool level is maintained by the intake ports of the principal spillway. Normal operating procedure does not require a dam tender but periodic closure of intake ports is required to maintain an acceptable discharge water quality. The principal spillway is controlled by a gate valve at the downstream toe of Embankment A. Upstream control can be accomplished by closing the intake ports of the structure.

The emergency spillway and underflow pipes operate in an uncontrolled manner and do not require specific operator attention other than for routine maintenance.

4.2 MAINTENANCE OF DAM

The embankments and appurtenances are maintained by the United States Steel Corporation. Maintenance reportedly consists of periodically repairing eroded and sloughed areas and making miscellaneous repairs as necessary.

4.3 INSPECTION OF DAM

The United States Steel Corporation is required by the State of Pennsylvania to inspect the dam annually and make needed repairs.

The United States Steel Corporation is required by MSHA to inspect the dam at least once every seven days and to make an annual report and certification of the dam.

4.4 WARNING SYSTEM

There is no warning system and no formal emergency procedure to alert or evacuate downstream residents upon threat of a dam failure.

4.5 EVALUATION

Principal spillway operating facilities are sufficient to provide adequate flow control.

The current dam maintenance program appears to be adequate and should be continued. However, there are no written operation, maintenance or inspection procedures, nor is there a warning system or formal emergency procedure for this dam. These procedures should be developed in the form of checklists and step by step instructions, and should be implemented as necessary.

SECTION 5 HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

a. Design Data: The Refuse Settling Basin has a watershed of 106 acres which is vegetated primarily by grassland. The watershed is about one half mile long and one half mile wide and has a maximum elevation of 1,220 feet (MSL).

The Basin is formed by two embankments. The north embankment, denoted as B is across the head of the valley. The south embankment, denoted as A is across the lower portion of the valley. The Basin is used to settle out the fines from a coal preparation plant slurry. The normal pool elevation therefore changes as the Settling Basin fills.

At the emergency spillway crest elevation (maximum design pool) 1155, the basin has a surface area of 38.4 acres and a storage capacity of 1800 acre-feet. The emergency spillway consists of a trapezoidal riprap lined earth channel with a 15 foot base width and side slopes of 1.5H:1V. The emergency spillway is located on the left abutment of Embankment A.

Spillway capacity and embankment freeboard were made sufficient to accommodate 265 cubic feet per second which was considered sufficient for this structure and watershed at the time of design.

According to PennDER files, a freeboard hydrograph was developed for 100% of a PMP of 25.8 inches in 6 hours. Reservoir routing of this storm through the 15 foot wide emergency spillway resulted in a maximum water surface elevation of 1157.96 feet. The above calculation was performed assuming an emergency spillway crest and maximum sediment elevation at 1155.0 and a top of dam elevation of 1158.0. No other hydrologic calculations were found relating reservoir/spillway performance to the Probable Maximum Flood or fractions thereof.

b. Experience Data: Records are not kept of reservoir level or rainfall amounts. There is no record or report of the embankments ever being overtopped.

c. Visual Observations: On the date of the field inspection, no serious deficiencies were observed that would prevent the emergency spillway from functioning. The pool elevation, at the time of the inspection, was about 36 feet below the crest of the dam.

The stadia survey performed during the Phase I investigation indicated that the minimum elevation of the Embankment B crest was 1155.8. The benchmark elevation used for the Embankment B survey was the concrete apron of the underflow pipe inlet structure, which may or may not have had the Elevation 1118 indicated on the design drawings. By observation, failure of Embankment B would not imperil inhabited dwellings and overflows would drain via the underflow pipes. Consequently, the overtopping analysis was performed assuming that the crest of Embankment B was everywhere higher than the crest of Embankment A.

d. Overtopping Potential: Overtopping potential was investigated through the development of the Probable Maximum Flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway. The Corps of Engineers guidelines recommend the Probable Maximum Flood (PMF) for "intermediate" size, "high" hazard dams. Based on the size and hazard classification, the Refuse Settling Basin has a Spillway Design Flood (SDF) of the PMF.

Hydrometeorological Report No. 33 indicates the adjusted 24 hour Probable Maximum Precipitation (PMP) for the subject site is 19.4 inches. No calculations are available to indicate whether the reservoir and spillway are sized to pass a flood corresponding to the runoff from 19.4 inches of rainfall in 24 hours. Consequently, an evaluation of the reservoir/spillway system was performed to determine whether the dam's spillway capacity is adequate under current Corps of Engineers guidelines.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies and key input data for this program are discussed briefly in Appendix D.

The peak inflow to the Refuse Settling Basin was determined by HEC-1 to be 640 cfs for a full PMF.

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e. Spillway Adequacy: The capacity of the combined reservoir and emergency spillway system was determined to be in excess of 100% of the PMF by HEC-1. According to Corps of Engineers' guidelines, the combined reservoir spillway capacity of the Refuse Settling Basin is "adequate".

SECTION 6 STRUCTURAL STABILITY

6.1 AVAILABLE INFORMATION

a. Design and Construction Data: All available design documentation, calculations and other data received from the Pennsylvania Department of Environmental Resources and the United States Steel Corporation were reviewed. Embankment stability analysis were performed by U.S.S. design engineers using assumed parameters and by L. Robert Kimball Consulting Engineers using results of a soils investigation.

The results of part of the latter analysis for static, long term conditions at Embankment A, are presented as Plate VII in Appendix E.

Both embankments were designed as zoned structures with impervious clay cores and foundation cutoffs to bedrock. Foundation grout curtains were also provided. The upstream shells were to be riprap covered, random earthfill materials and the downstream shells were to be coarse coal refuse with topsoil covering. Downstream slopes were to be 2.5H:1V with 10 foot wide benches at 40 foot vertical intervals.

Construction of the dams in accordance with the approved plans and specifications was certified by the U.S.S. Corporation Design Engineer on 1 November 1978.

Inspection reports by state personnel during the course of construction did not indicate significant changes from design plans.

The application review report by the PennDER Chief of Dam Safety, states that factors of safety, well above the accepted standards, were derived for end of construction steady seepage and earthquake loading conditions. Due to the nature of the impoundment, the rapid drawdown condition was not considered.

b. Operating Records: There are no written operating records or procedures for this dam.

c. Post-Construction Changes: There are no reported post construction modifications to these embankments.

d. Visual Observations: The field inspection disclosed no strong evidence of potential instability of either embankment. The slopes showed no signs of major displacements. However, considerable minor sloughing was observed on the lower downstream slope of Embankment A. The sloughing was reported to be due to sliding of the topsoil cover on the coal refuse fill material. Numerous, previous sloughs have been repaired in the past as indicated by strips of differing vegetation.

Also, several animal burrows were observed in the area of sloughing.

No direct embankment seepage or marked vegetal changes indicating embankment seepage were observed on either embankment during the field reconnaissance. However, swampy conditions were observed at and below the toe of the Embankment A.

e. Performance: There has been no indication or report of any problems with the performance of these embankments over their two year life.

6.2 EVALUATION

a. Design Documents: The design documentation was by itself, considered inadequate to evaluate the structures. The structural calculations were not available for review.

b. Embankment: Based on the results of the visual observations of embankment slopes, materials, seepage and groundwater conditions, Embankment B is considered to have an adequate margin of safety against sliding.

The margin of safety against sliding of Embankment A however, may not be adequate and should be investigated further. This evaluation is based on the observed minor topsoil sloughing which occurs mostly on lower slopes, the existence of animal burrows in this area, and the existence of swampy conditions at and below the toe of the embankment. These conditions may indicate a high groundwater level in the embankment which would not be in accordance with groundwater conditions assumed for the stability analysis shown on Plate VII, Appendix E.

c. Emergency Spillway: Based on results of the visual inspection, the emergency spillway structure for the Refuse Settling Basin appeared to be stable.

d. Underflow Pipes: On the date of the field inspection, the underflow pipes appeared to be structurally sound. However, a slump condition was observed on Embankment A, immediately behind the outlet structure that could threaten the integrity of the pipes if further movement occurs.

e. Seismic Stability: According to the Seismic Risk Map of the United States, Refuse Settling Basin is located in Zone 1 where damage due to earthquake would most likely be minor.

A dam located in Seismic Zone 1 may be assumed to present no hazard from an earthquake provided static stability conditions are satisfactory and conventional safety margins exist. Since there is concern regarding the static stability of Embankment A, the seismic stability is questionable and should be assessed as part of the investigations recommended in Section 7.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS

7.1 ASSESSMENT

a. Evaluation:

(1) Embankment A: Embankment A is considered to be in overall fair condition. This assessment is based primarily on the possibility of high ground water in the embankment. This condition is not considered to represent an immediate threat to the structure because of the relative low impoundment pool level. However, it should be evaluated. Otherwise, the embankment would be considered to be in good condition requiring only minor maintenance efforts.

(2) Embankment B: Embankment B is considered to be in good condition, requiring only minor maintenance efforts. However, the apparent low crest elevation should be investigated and corrected, if required.

(3) Principal Spillway: The condition of the principal spillway is considered to be good.

(4) Underflow Pipes: The condition of the underflow pipes is considered to be good. However, continued sloughing or movement of the toe of Embankment A behind the outlet structure could threaten the structural integrity of the pipes.

(5) Emergency Spillway: The condition of the Emergency Spillway is considered to be good. This is based on an "adequate" capacity rating determined using the HEC-1 computer program. The emergency spillway was found to pass in excess of 100% of the Probable Maximum Flood. The Spillway Design Flood is the PMF because of the embankments size and hazard classification.

b. Adequacy of Information: The information available on design, construction, operation and performance history in combination with visual observations and hydrologic and hydraulic calculations was sufficient to evaluate the embankment and appurtenant structures in accordance with the Phase I Investigation guidelines.

c. Urgency: The recommendations presented in Sections 7.2a and b should be implemented immediately.

d. Necessity for Additional Data/Evaluation: Additional engineering information is required to adequately evaluate the structural stability of Embankment A.

7.2 RECOMMENDATIONS

a. Additional Investigations: It is recommended that the owner immediately retain the services of a registered professional engineer knowledgeable and experienced in the design and construction of earth dams to provide an evaluation of the stability of Embankment A. This evaluation should include but not be limited to the following:

- (1) Review and evaluation of monitoring instrument data.
- (2) Investigation of the swampy conditions at and below the toe.
- (3) Stability calculations if necessary.

b. Emergency Operation and Warning Plan: Concurrent with the additional investigations recommended above, the owner should develop an Emergency Operation and Warning Plan including:

- (1) Guidelines for evaluating inflow during periods of heavy precipitation or runoff.
- (2) Procedures for around the clock surveillance during periods of heavy precipitation or runoff.
- (3) Procedures for drawdown of the reservoir under emergency conditions.
- (4) Procedures for notifying downstream residents and public officials, in case evacuation of downstream areas is necessary.

c. Remedial Work. The Phase I Inspection of the Refuse Settling Basin also disclosed several other deficiencies which should be corrected during routine maintenance.

- (1) Repair minor sloughing and minor erosion, and backfill animal burrows observed on and adjacent to Embankment A.

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(2) Repair minor erosion observed adjacent to the underflow pipe inlet structure.

(3) Determine the true elevation of the Embankment B crest with respect to Embankment A, and raise if necessary.

(4) Repair the embankment slough adjacent to the underflow pipe outlet structure and monitor to assure that future movements do not imperil the structural integrity of the underflow pipes.

(5) Repair the sloughs that have occurred along the diversion channel in the upper reservoir area.

(6) Remove the sediments from the stilling pool area below Embankment A and monitor to determine source of any new sediment deposited therein.

APPENDIX A
VISUAL INSPECTION CHECKLIST

VISUAL OBSERVATIONS CHECKLIST I
(NON-MASONRY IMPOUNDING STRUCTURE)

Name Dam Refuse Settling Basin County Washington State Pennsylvania ID # PA 00908 National

Type of Dams Earthfill/Rockfill Hazard Category High

Date of Inspection 5 May 1980 Weather Clear, warm Temperature 75°F

Pool Elevation at Time of Inspection 1124.9 (MSL)

Tailwater at Time of Inspection 1067.1

Inspection Personnel: J. E. Barrick, P.E. Ackenheil & Associates, Hydrologist and
Project Manager.

J. P. Hannan
S. G. Mazzella
J. D. Floris

Ackenheil & Associates, Geotechnical Engineer
Ackenheil & Associates, Civil Engineer
U.S. Steel Corporation, Company Representative

Recorder J. E. Barrick

GEO Project G79153-Y
PENNDER I.D. No. 63-78

EMBANKMENT A

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
<u>SURFACE CRACKS</u>	<p>A few minor drying cracks were observed along the crest and at various locations on the embankment.</p> <p>On the slope below the first bench of the downstream face, numerous tension cracks and scarps were observed along the entire length of the slope. In some cases, the scarps had associated bulges at lower portions of the slope. In general, the distress appeared to be due to surficial sloughing.</p> <p>Several animal burrows were observed on the downstream slope.</p>	
<u>UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE</u>	<p>None observed.</p>	
<u>SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES</u>	<p>Several embankment slope (downstream) slough areas were observed at elevations below the first (highest) bench. Also, vertical strips of differing vegetation were noted. The U.S.S. representative stated that the sloughs were the result of topsoil sliding on the coal refuse fill and the strips were the result of past repairs of such sloughs. Some minor erosion of topsoil was noted.</p> <p>A slough area that appeared to be deeper than a topsoil sliding condition was observed at the toe of the embankment above and to the left of the underflow pipes outlet structure. The slough was located just above a soft area.</p> <p>No sloughing or significant erosion of abutment slopes was observed.</p>	

EMBANKMENT A (CONTINUED)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	<p>The crest appeared to have the proper alignment, both vertically and horizontally. The crest appeared quite level and no offsets or discontinuities were observed. The crest contains an access road which was gravel covered the entire length.</p>	
RIPRAP FAILURES	<p>The riprap on the upstream slope of the embankment was observed to be in excellent condition. No erosion or gullies were observed. The covering of riprap appeared to be generally uniform. The riprap in the groin channel along the right abutment was generally in good condition though some displacement of rocks was noted, probably due to large flows. The overall condition appeared good.</p> <p>The riprap protection at the downstream toe of the slope was in fair condition. Numerous outcrops of black coal refuse were observed. The thickness in uniformity of the riprap was considerably less along the toe than on the upstream slope. No serious erosion of coal refuse was observed in the toe area.</p>	
SETTLEMENT	None observed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	<p>The emergency spillway crosses the far left abutment. The channel was rock lined, 15 feet wide and 3 feet deep at the intersection with the Embankment A crest centerline.</p> <p>No significant erosion was observed anywhere along the junction of the embankment and the spillway. The junction of the embankment and the abutment around the entire perimeter of the dam was observed to be in good condition. The groin was heavily grassed and no erosion was observed.</p>	

EMBANKMENT A (CONTINUED)

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
ANY NOTICEABLE SEEPAGE	Two major soft areas were observed near and below the left toe of the embankment. No flowing water was observed, but soft soil conditions and standing water were observed.	
STAFF GAGE AND RECORDER	None observed.	
DRAINS	None observed.	

EMBANKMENT B

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
<u>SURFACE CRACKS</u>	None observed.	
<u>UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE</u>	None observed.	
<u>SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES</u>	None observed.	
<u>VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST</u>	The crest of Embankment B appeared straight and level.	
<u>RIPRAP FAILURES</u>	None observed. Riprap covered entire upstream slope. Rock diameters ranged from 2 to 3 inches through 2 feet. Coverage was generally uniform; riprap was in very good condition.	
<u>SETTLEMENT</u>	None observed.	
<u>JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM</u>	Along the upper portion of the downstream toe of the embankment, the groins were grassed and in good condition. Only very minor channel erosion observed. Flow stilling and sedimentation control is provided by numerous hay bail sediment traps along both upper groins. The toe of the structure is a rock fill erosion protection. The groins in this vicinity appeared to be in good condition. Some undercutting erosion was observed beneath the rock fill immediately adjacent to the right side of the concrete headwall at the inlet to the underflow pipes.	

* Embankment B downstream slope lies up-valley of the upstream (pond side) slope.

EMBANKMENT B (CONTINUED)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	None.	
STAFF GAGE AND RECORDER	None observed.	
DRAINS	A six inch asphalt coated CMP drain, with a trickle flow, was discharging to the underflow pipes inlet channel from beneath the left abutment. The flow rate was too small to measure. No drain was observed on the right side of the embankment.	

PRINCIPAL SPILLWAY
(Outlet Works)

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONDUIT	<p>The principal spillway conduit for the Refuse Settling Basin consists of a twenty inch diameter steel pipe that passes beneath the reservoir and Embankment A and discharges through a measuring weir type outlet structure to a downstream channel.</p>	
INTAKE STRUCTURE	<p>The intake structure is a drop inlet facility located on the shore opposite Embankment A. The inlet consists of a series of steel port, drop inlet structures evenly spaced along the slope to accommodate rising pool levels. The pool level is currently maintained by two such inlets at the pool level. As the sediment level rises in the pond, the lower ports will be closed off, the water level will rise to the next two ports and inlet will continue at that elevation until the quality of the discharge water requires raising the pool level again. Access to the inlet ports is by a steel staircase down the reservoir slope. Two detachable screens are used as trash collectors at the operative inlet ports.</p> <p>The condition of the intake structure was excellent.</p>	
OUTLET STRUCTURE	<p>The outlet structure consists of a concrete outlet box at the toe of the dam. The 20 inch steel pipe passes beneath the dam, through a 20 inch gate valve in the concrete box, and then to the measuring weir where the pipe has a 90° fitting turned so that flow into the measuring box is vertical. Flows are then directed over a rectangular weir at the downstream end of the box. Discharge is to riprap below the box and into the discharge channel below the dam.</p>	

PRINCIPAL SPILLWAY (CONTINUED)
(Outlet Works)

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
OUTLET STRUCTURE CONT'D	The condition of concrete surfaces and metal equipment was excellent.	
EMERGENCY GATE	Gate valve described in Outlet Structure above.	

EMERGENCY SPILLWAY

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
<u>GENERAL</u>	The Refuse Settling Basis emergency spillway is an uncontrolled open channel around the left end of Embankment A. The dam crest access road passes through the spillway via a riprap covered "Texas Crossing."	
<u>APPROACH CHANNEL</u>	The approach channel to the emergency spillway was observed to be clear and free of debris. The approach channel slope was measured to be approximately 3%.	
<u>FLOW CONTROL</u>	Emergency spillway flow control is by broad crested weir at the access road crossing. The crest width was thirty feet and the length was fifteen feet. Channel side slopes approaching and leaving the "Texas Crossing" were approximately 3H:2V.	
<u>DISCHARGE CHANNEL</u>	The discharge channel consists of a riprap lined trapezoidal open channel that passes through and down the left abutment beyond the toe of the left end of the embankment. The channel discharges to a grass waterway below the toe of Embankment A. The discharge channel slope was observed to be greater than 4%.	
<u>BRIDGE AND PIERS</u>	None observed.	

UNDERFLOW PIPES

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL		
	The watershed above Embankment B is drained by two 20 inch steel pipes that pass beneath both embankments and the reservoir.	
INLET STRUCTURE	The inlet structure is located at the downstream (up-valley) toe of Embankment B and consisted of a reinforced concrete headwall with approach slab and 45° wingwalls. The inlet is protected by a steel grate type trash rack.	The observed condition of the intake structure was excellent.
OUTLET STRUCTURE	The outlet structure was located at the downstream toe of Embankment A, immediately to the left of the Principal Spillway outlet structure.	This structure was identical to the inlet structure and was observed to be in excellent condition.

INSTRUMENTATION

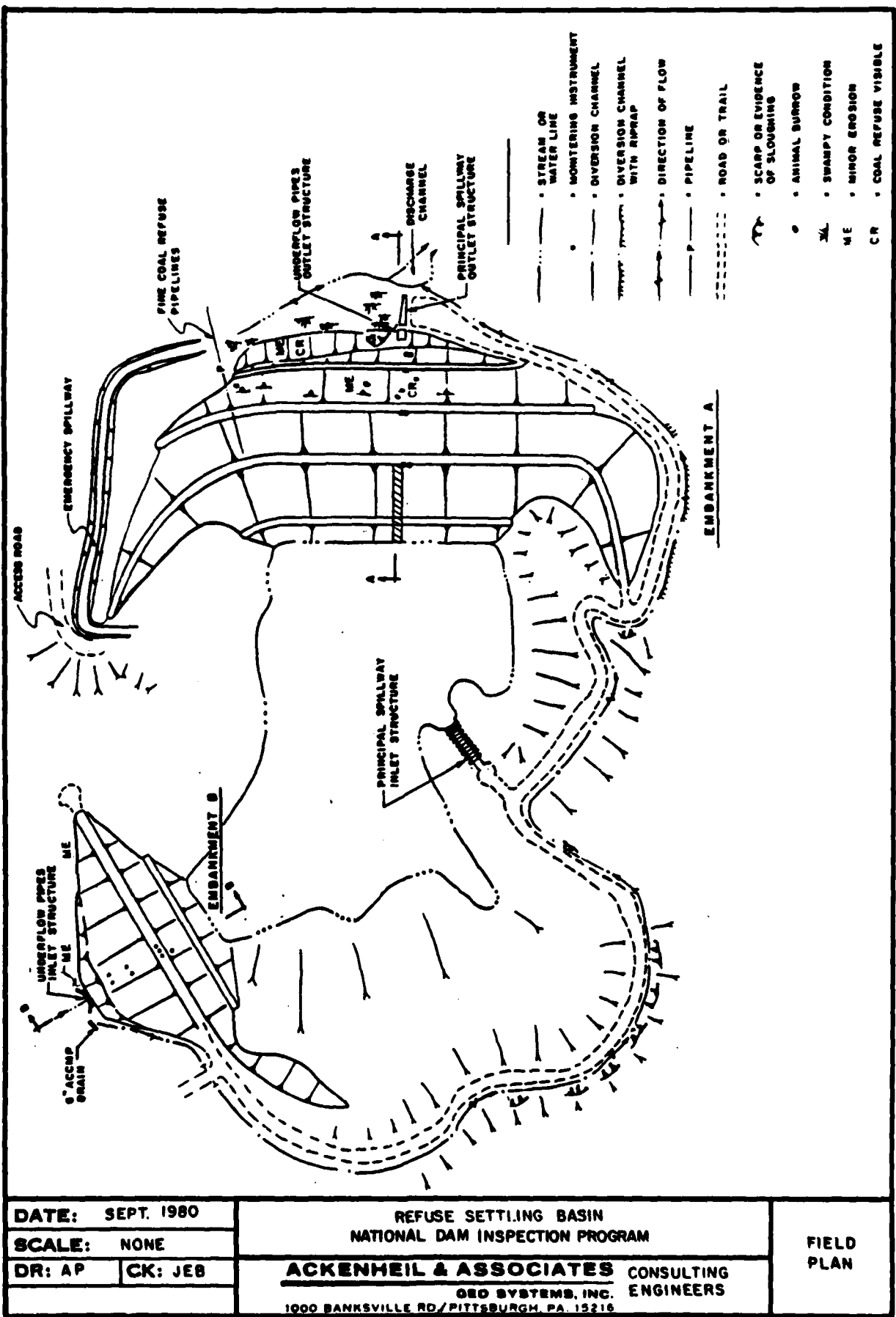
<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
<u>MONUMENTATION/SURVEYS</u>	None observed.	
<u>OBSERVATION WELLS</u>	Several observation wells were observed on the crest and downstream slope of each embankment.	
<u>WEIR</u>	A rectangular flow measuring weir is located in the principal spillway outlet structure at the toe of Embankment A.	
<u>PIEZOMETERS</u>	Several piezometers were observed on the crest and downstream slope of each embankment.	
<u>OTHER</u>	Slope indicator and settlement measuring devices were observed on the crest and downstream slope of each embankment.	

DOWNSTREAM CONDITIONS

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
DISCHARGE CONDITIONS (OBSTRUCTIONS, DEBRIS, ETC.)	<p>The discharge channel for the Principal Spillway outlet works and the underflow pipes is an open channel, excavated into natural ground below the downstream toe of Embankment A.</p> <p>On the date of inspection, the upper end of the channel contained some sediment and cattail growth but appeared to be more than adequate to handle potential flows.</p> <p>The channel alignment is generally straight for approximately 1000 feet to a point where the channel discharges to the original creek channel below the toe of the adjacent Treated Water Pond.</p>	
APPROXIMATE NO. OF HOMES AND POPULATION	<p>Eight inhabited dwellings were observed in the creek valley in the first two miles below the Refuse Settling Basin. Also, mine portal and coal loading facility would be threatened by high flows.</p> <p>Ginger Hill Road (State Route 917) parallels the creek down to the confluence with Sawmill Creek, two miles below the dam.</p>	

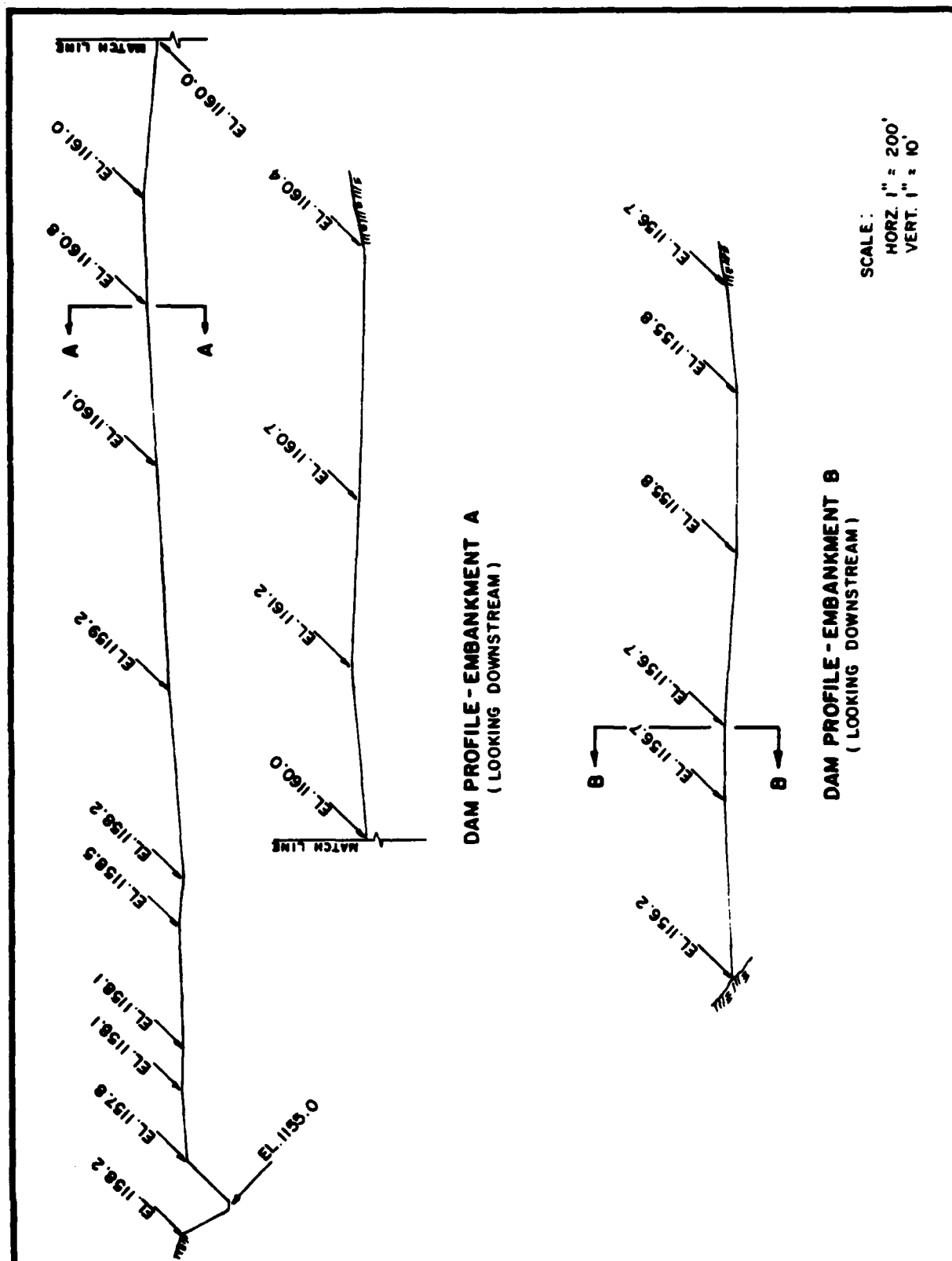
RESERVOIR

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
<u>SLOPES</u>	The reservoir slopes were observed to be generally flat to moderate and were entirely grassed both above and below the embankment crest elevation. Minor surficial sloughing was observed at several locations on steeper slopes both below and above the embankment crest elevation.	
<u>INLET STREAM</u>	There is no natural inlet stream to reservoir and upper watershed flows are diverted away from the impoundment by a diversion channel. Fine coal refuse (slurry) is transported to the impoundment by two steel pipes that discharge onto the upstream slope of Embankment A near the center of the dam.	
<u>SEDIMENTATION</u>	The impoundment area is a disposal facility for fine coal refuse (slurry) from the Maple Creek Mine preparation plant. Consequently, considerable sediment has been impounded particularly in the area below the outfall for the slurry pipelines.	
<u>WATERSHED</u>	The watershed is quite small as the dam has been constructed near the top of a hill. The watershed is entirely grassed with only a few small trees visible.	



- STREAM OR WATER LINE
- MONITORING INSTRUMENT
- DIVERSION CHANNEL
- DIVERSION CHANNEL WITH RIPRAP
- DIRECTION OF FLOW
- PIPELINE
- ROAD OR TRAIL
- SCARP OR EVIDENCE OF SLOUGHING
- ANIMAL BURROW
- SWAMPY CONDITION
- MINOR EROSION
- COAL REFUSE VISIBLE

DATE: SEPT. 1980		REFUSE SETTLING BASIN NATIONAL DAM INSPECTION PROGRAM		FIELD PLAN
SCALE: NONE				
DR: AP	CK: JEB	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS		
		GEO SYSTEMS, INC. 1000 BANKSVILLE RD./PITTSBURGH, PA. 15216		



DATE: SEPT. 1980

SCALE: As Shown

DR: AP

CK:

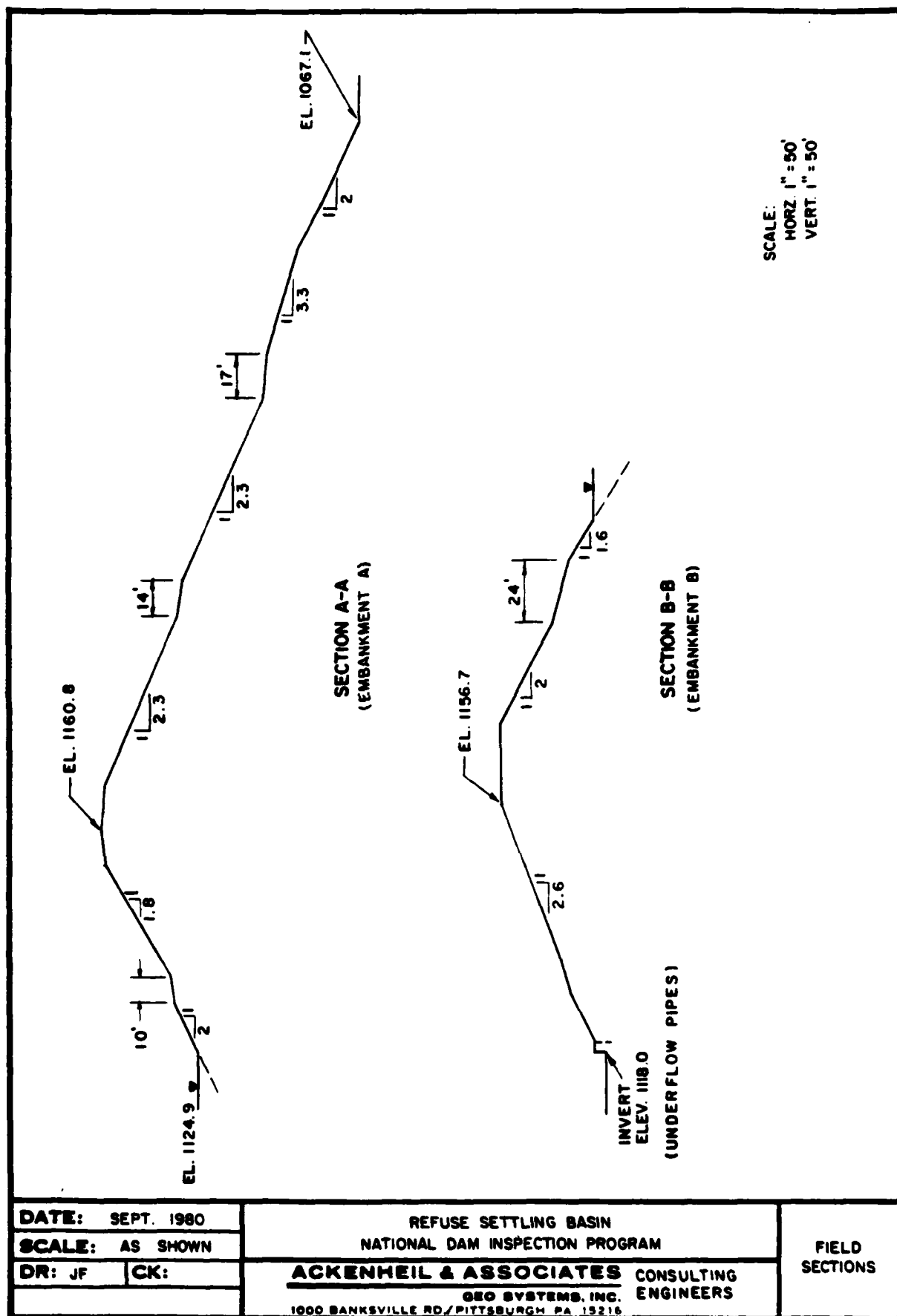
REFUSE SETTLING BASIN
NATIONAL DAM INSPECTION PROGRAM

ACKENHEIL & ASSOCIATES CONSULTING

GEO SYSTEMS, INC. ENGINEERS

1000 BANKSVILLE RD./PITTSBURGH PA 15216

FIELD
PROFILE



APPENDIX B
ENGINEERING DATA CHECKLIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Refuse Settling Basin
I.D. No. PA 00908

ITEM	REMARKS
------	---------

Design Drawings (1)

Drawings by L. Robert Kimball and Associates, Ebensburg, Pennsylvania for Maple Creek, Refuse Settling Basin, Maple Creek Foreign Drawing 041, including:

- | | |
|--------------|--|
| Sheet 1 | - General Plan (2)(3) |
| Sheet 2 | - Embankment Geometry and Temporary Sedimentation Basins |
| Sheet 3 | - Boring Layout and Borrow Areas (2) |
| Sheets 4-8 | - Test Borings (2) |
| Sheet 9 | - Geological Cross-Sections |
| Sheet 10 | - Geological Profiles |
| Sheet 11 | - Spillway and Diversion Ditch Details (2)(3) |
| Sheet 12 | - Dual 20 inch Drainage Line - Profile and Sections (2)(3) |
| Sheet 15 | - Stability Analysis (2)(3) |
| Sheet 18 | - Typical Embankment Section |
| Sheets 19-22 | Embankment A Cross-Sections |
| Sheets 23-24 | Embankment B Cross-Sections |
| Sheet 25 | - Erosion and Sediment Control |
| Sheet 26 | - Monitor Details, Section (2)(3) |

Drawings by U.S.S. 73-Q-17 including:

- | | |
|----------|---|
| Sheet 15 | - Plan of Site Preparation - Location of Gas Lines. |
| Sheet 16 | - Geometry of Roadway, Diversion Ditch, Decant and Drainage Lines |

ITEM	REMARKS
Design Drawings (1) (continued)	<p>Sheet 17 - Decant Profile and Sections</p> <p>Sheet 18 - Decant Stairs and Walkway Details</p> <p>Sheet 19 - Decant Support, Endwalls and Thrust Block Welding Collar</p> <p>Sheet 20 - Decant Valve Box, Cutoff Collars and Guard Post Details</p> <p>Sheet 21 - Endwall Screen and Pipe Collar</p> <p>Sheet 22 - Roadway Profiles and Typical Sections</p> <p>Sheet 23 - Plan of Subsurface Information and Borrow Areas</p> <p>Sheets 24-29 Subsurface Profiles at Borrow Areas</p> <p>Sheet 30 - Decant Inlet Screen Detail</p> <p>Sheet 31-35 Weir Plan and Details</p> <p>Sheet 38 - Embankment A and B Entry Roads</p>
As-Built Drawings	None available.
Regional Vicinity Map	U.S.G.S. 7-1/2 Minute Hackett and Monongahela, Pennsylvania Quadrangle Map. (3)
Construction History	<p>Constructed by Trumbull Corporation of Pittsburgh, Pennsylvania between 1975 and 1978. The dams were completed on 27 October 1978.</p> <p>See progress reports by Regional Hydraulic Engineer dated 11 July 1978, 16 August 1978, 14 September 1978. See Completion report by Regional Hydraulic Engineer dated 21 November 1978.</p>

ITEM	REMARKS
*Construction History (Continued)	See construction progress reports by Robert Witt, Jr. Chief Engineer, U.S.S. dated 5 June 1978, 5 July 1978, 11 August 1978, 6 September 1978, 9 October 1978 and Dam Completion Report dated 1 November 1978.
Typical Sections of Dam	See Design Drawings.
Outlets-Plans Details Constraints Discharge Ratings	See Design Drawings.
Rainfall/Reservoir Records	None available.
*Design Reports	See "Report Upon the Application of United States Steel Corporation", dated 3 July 1980 prepared by the Chief, Dams Safety Section, Division of Dams and Encroachments, Pennsylvania Department of Environmental Resources. See E.J. Steele, PennDER Geologist Review Report listed under Miscellaneous below.
*Geology Reports	See Design Reports above.
Design Computations	None available.
*Hydrology and Hydraulics	See Design Reports above.
*Dam Stability	See Design Reports and Design Drawings above. Also see Encroachment Permit Application under Miscellaneous below.

ITEM	REMARKS
*Seepage Studies	See Design Reports above.
*Materials Investigation, Boring Records, Laboratory, Field	See Design Drawings above. See Design Reports above.
Post-Construction Surveys of Dam	None recorded.
Borrow Sources	See Design Drawings above.
Monitoring Systems	See Design Drawings.
Modifications	None reported.
High Pool Records	None available.
Post-Construction Engineering Studies and Reports	None available.
Maintenance, Operation, Records	None available.
Spillway Plan Sections Details	See Design Drawings above.
Operating Equipment Plans and Details	See Design Drawings above.
Specifications	None available.

ITEM

REMARKS

*Miscellaneous

Miscellaneous correspondence involving applications, requirements and approval conditions including:

Encroachment Permit Application and background information dated 8 March 1974 that included:

1. Erosion and Sedimentation Plan (Exhibit #5)
2. Fracture Trace Analysis (Exhibit #6)
3. Dam Stability Analysis (Exhibit #10)
4. Geologic Investigation (Exhibit #11)

Letter of transmittal for dam encroachment permit application from R. R. Godard, Chief Engineer, U.S.S. to Pennder, Division of Dams and Encroachments, dated 17 June 1974.

Review of the encroachment permit application by Edward J. Steele Geologist, Pittsburgh Office, Pennder, dated 25 November 1974.

Request to U.S.S. on 2 July 1974 by Pennder to have a "full-scale" soils and foundation investigation by a competent soils engineering firm.

Permit to construct two earthen dams across an unnamed tributary to Sawmill Creek, dated 7 July 1975.

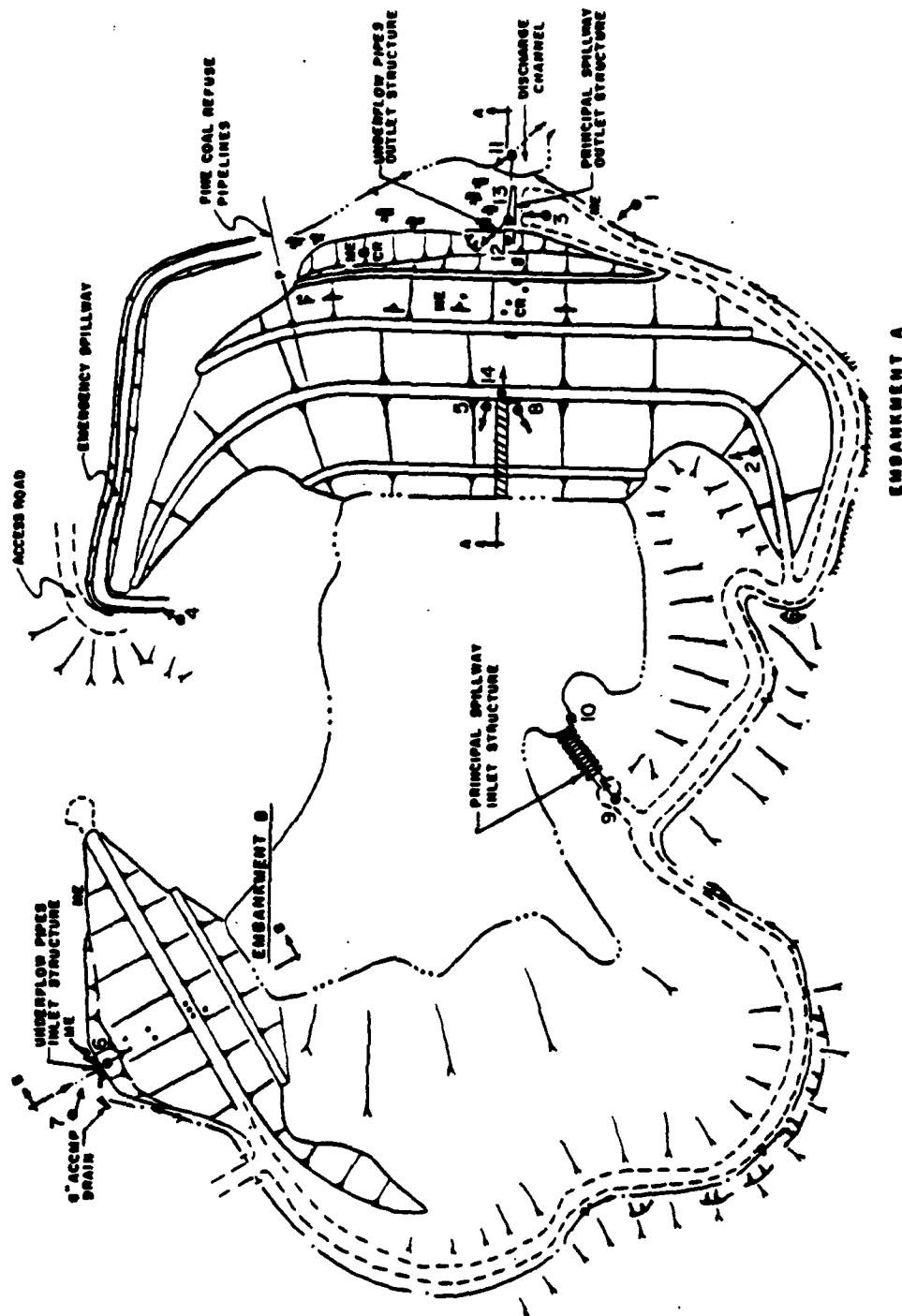
ITEM	REMARKS
Prior Accidents or Failure of Dam Description Reports	None reported.

B6

*Information and data may be obtained from the PennDER, Harrisburg, Pennsylvania.

- (1) United States Steel Corporation Documents.
- (2) Obtained from U.S.S. Corporation
- (3) Reduced size reproductions contained in Appendix E.

APPENDIX C
PHOTOGRAPHS



DATE: SEPT. 1980

SCALE: NONE

DR: AP CK: JEB

DWG. NO.

REFUSE SETTLING BASIN
NATIONAL DAM INSPECTION PROGRAM

ACKENHEIL & ASSOCIATES CONSULTING
GEO SYSTEMS, INC. ENGINEERS
1000 BANKSVILLE RD./PITTSBURGH, PA. 15216

PHOTO
KEY
MAP

REFUSE SETTLING BASIN

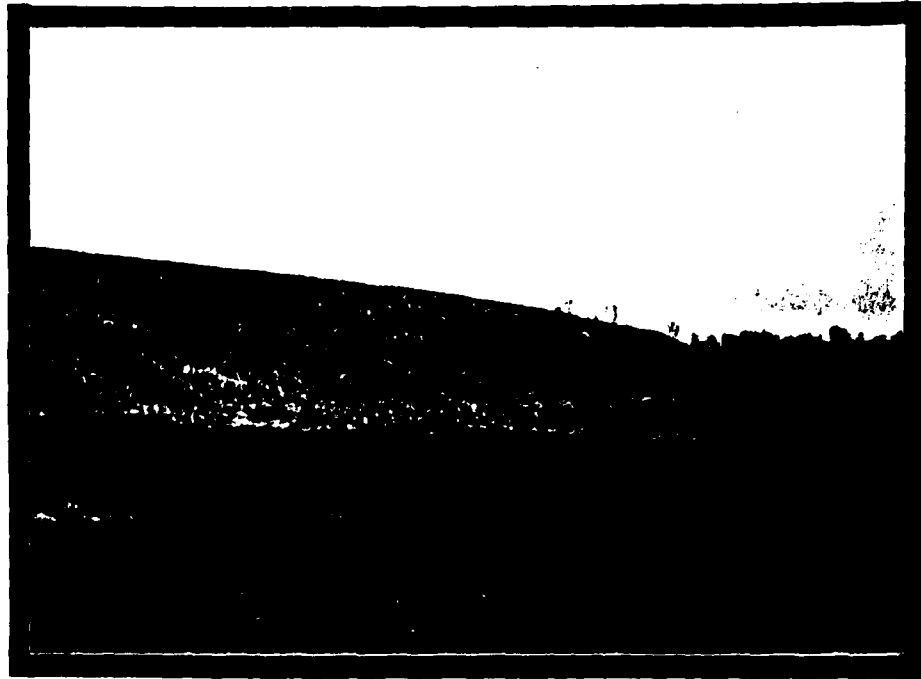


Photo 1 Embankment A - Downstream Slope (main embankment). Dark strips are surficial slough repair areas.



Photo 2 Embankment A - Upstream Slope. Dark strip at center of embankment is slurry discharge stream.

REFUSE SETTLING BASIN



Photo 3 Embankment A - Downstream Toe Area showing principal spillway outlet structure. Note swampy conditions beyond embankment toe.



Photo 4 Emergency Spillway Channel on left abutment of Embankment A.

REFUSE SETTLING BASIN



Photo 5 Embankment B - Upstream Slope.

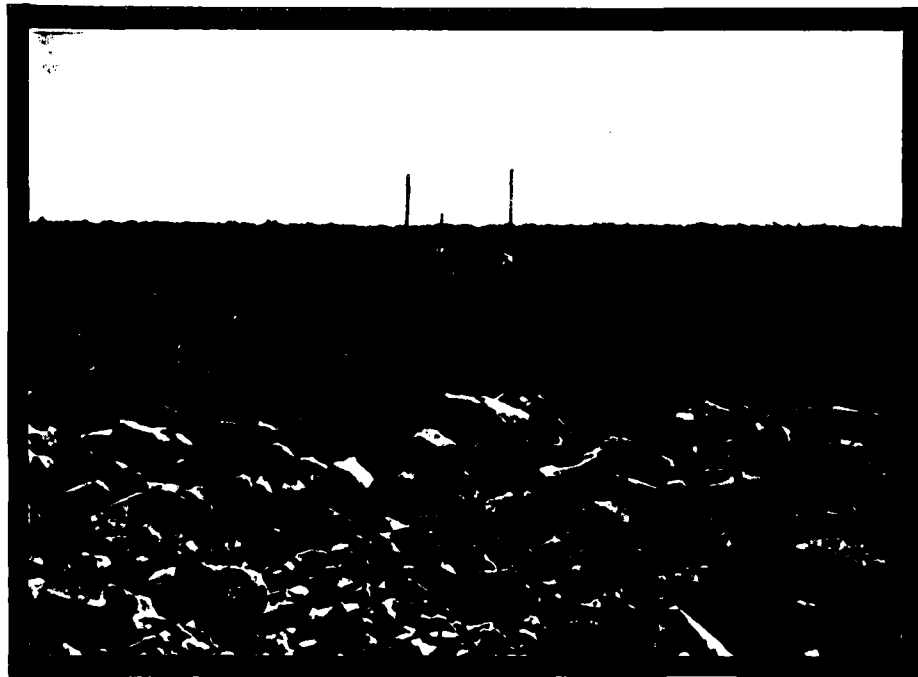


Photo 6 Embankment B - Downstream Slope showing instrumentation.

REFUSE SETTLING BASIN

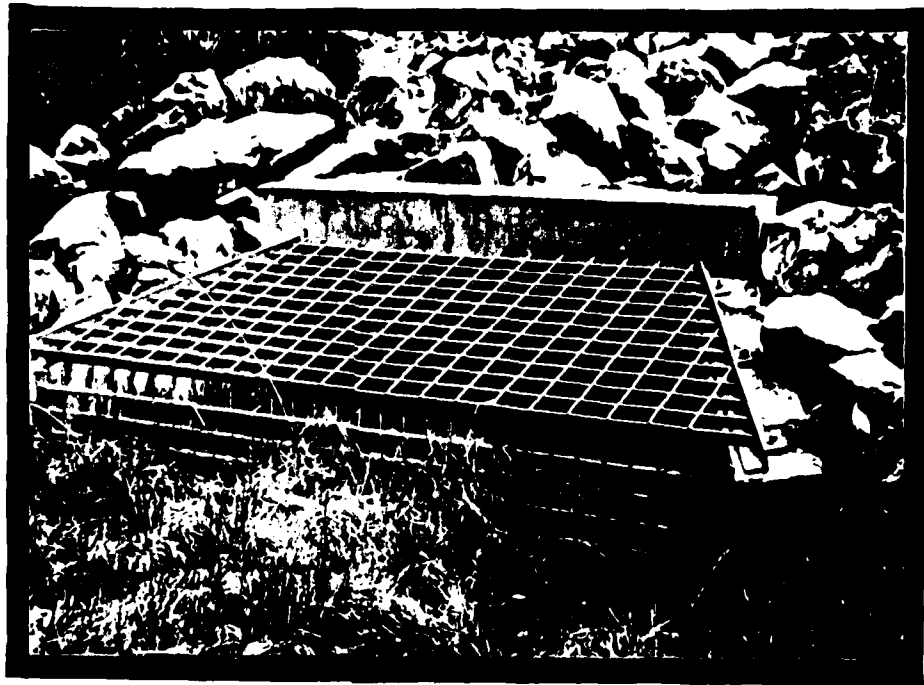


Photo 7 Underflow Pipes Inlet at downstream
(up-valley) toe of Embankment B.



Photo 8 Outlet Works Intake Structure as seen from
crest of Embankment A.

REFUSE SETTLING BASIN



Photo 9 Principal Spillway Intake Ports and access stairway.

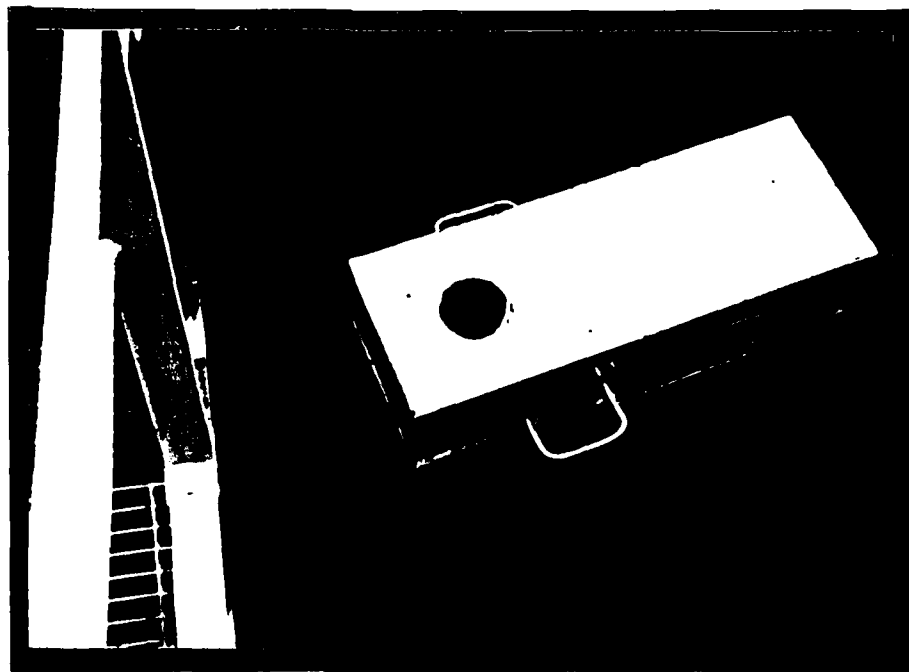


Photo 10 Principal Spillway Intake Port with flow control box.

REFUSE SETTLING BASIN

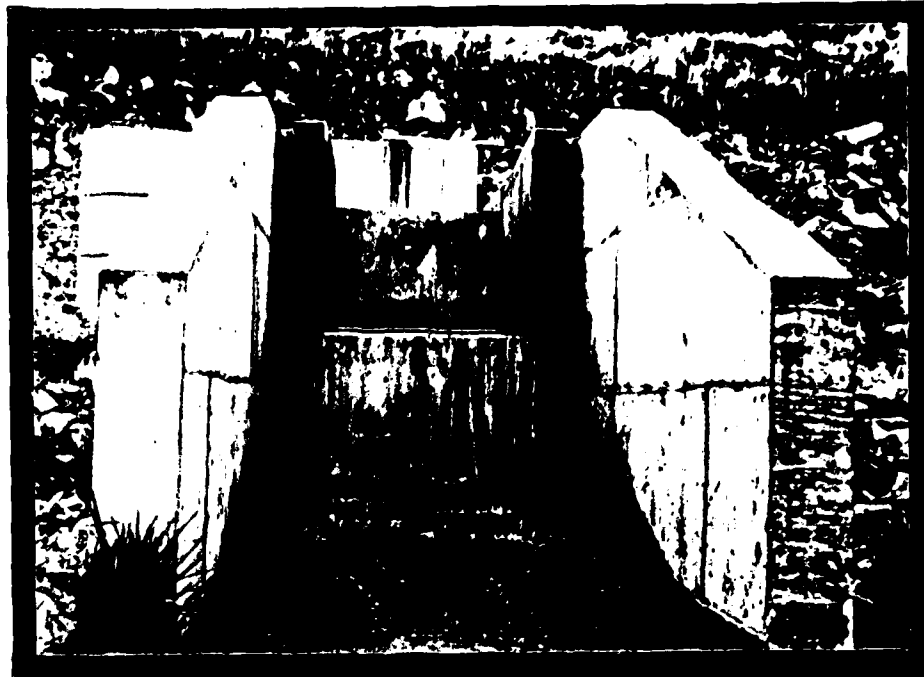


Photo 11 Principal Spillway Outlet Structure showing overflow weir from below.

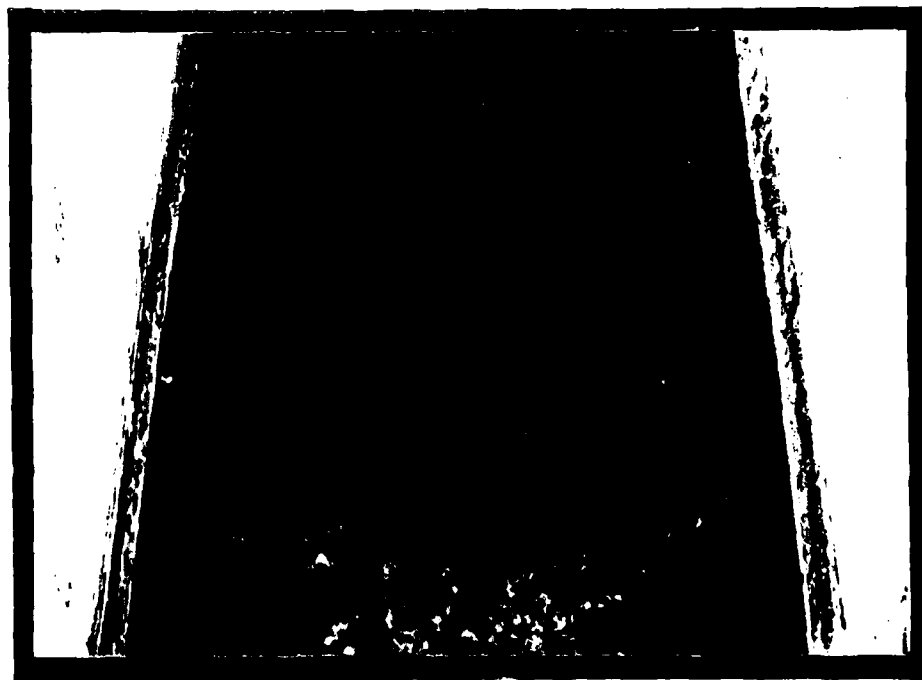


Photo 12 Principal Spillway Outlet Structure showing inlet to overflow weir chamber. Pipe shown is outlet end of pipe from intake structure.

REFUSE SETTLING BASIN

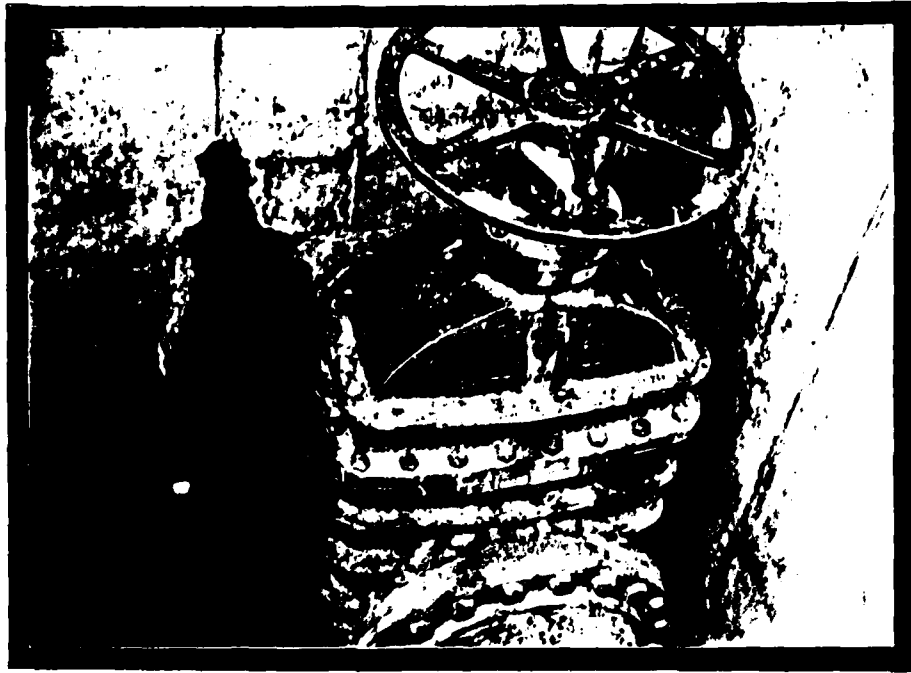


Photo 13 Principal Spillway Outlet Structure showing gate valve control which is immediately upstream of the overflow weir shown on Photo 11.



Photo 14 Discharge Channel and downstream conditions.

APPENDIX D
HYDROLOGY AND HYDRAULICS
ANALYSES

APPENDIX D HYDROLOGY AND HYDRAULICS

Methodology: The dam overtopping analysis was accomplished using the systemized computer program HEC-1 (Dam Safety Version), July, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation: The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 33" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph: The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters, their definition and how they were obtained for these analyses.

<u>Parameter</u>	<u>Definition</u>	<u>Where Obtained</u>
Ct	Coefficient representing variations of watershed	From Corps of Engineers
L'	Length of main stream channel + edge of pond	From U.S.G.S. 7.5 minute topographic map

Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic map

3. Routing: Reservoir routing is accomplished by using Modified Puls routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation-discharge relationship.

Storage in the pool area is defined by an area-elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping: Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Predominately grassland, no
development noted.

ELEVATION TOP NORMAL POOL (STORAGE
CAPACITY): 1155.0 (1800. acre-feet).

ELEVATION TOP FLOOD CONTROL POOL (STORAGE
CAPACITY): 1158.1 (1923 acre-feet.)

ELEVATION MAXIMUM DESIGN POOL: 1158.0

ELEVATION TOP DAM: 1160.1 (average) 1158.1 (minimum)

OVERFLOW SECTION

- a. Elevation 1155.0
- b. Type Trapezoidal Earth Channel
- c. Width 15 feet
- d. Length Overflow Crest of 30 feet
- e. Location Spillover Left abutment of Embankment A
- f. Number and Type of Gates None
- g. Side Slopes 1.5H:1V

OUTLET WORKS

- a. Type Decant structure
- b. Location North side of pond between Embankment
A and B.
- c. Entrance Inverts Varies with depth of sediment
- d. Exit Inverts 1067 ±
- e. Emergency Drawdown Facilities None

HYDROMETEOROLOGICAL GAGES

- a. Type None
- b. Location N/A
- c. Records None

MAXIMUM REPORTED NON-DAMAGING
DISCHARGE None reported

HEC-1 DAM SAFETY VERSION
HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Refuse Settling Basin NDI ID NO.
PA 00908

Probable Maximum Precipitation (PMP) 24.2*

Drainage Area 0.17 sq. mi.

Reduction of PMP Rainfall for Data Fit 0.8 (24.2)
Reduce by 20%, therefore PMP rainfall = 19.4 in.

Adjustments of PMF for Drainage Area (Zone 7)
6 hrs. 102%
12 hrs. 120%
24 hrs. 130%
48 hrs. 140%

Snyder Unit Hydrograph Parameters
Zone 29**
C_p 0.5
C_t 1.6
L' = 0.25 mile
t_p = C_t (L') 0.6 0.7 hour

Loss Rates
Initial Loss 1.0 inch
Constant Loss Rate 0.05 inch/hour

Base Flow Generation Parameters
Flow at Start of Storm 1.5 cfs/sq.mi=0.26 cfs
Base Flow Cutoff 0.05 x Q peak
Recession Ratio 2.0

Overflow Section Data
Crest Length 15 feet
Channel Slope 0.03 feet
Side Slopes 3H:2V
Mannings "n" 0.09
Discharge Capacity 293 cfs
Freeboard Above Overflow Crest 3.1 feet

* Hydrometeorological Report 33

**Hydrological zone defined by Corps of Engineers,
Baltimore District, for determining Snyder's Coefficients
(C_p and C_t).

ACKENHEIL & ASSOCIATES

GEO Systems, Inc.
1000 Banksville Road
PITTSBURGH, PA. 15216
(412) 531-7111

Job Return Settling BasinJob No. 79153YSubject Data InputMade By JPH Date 7-8-80 Checked 1/22 Date 8/1/80LOSS RATE AND BASE FLOW PARAMETERS

As Recommended by Corps of Engineers, Baltimore District

STRTL = 2 inch
CNLTL = 0.05 "/hr.
STRTO = 1.5 cfs/mi²
QRCSN = 0.05 (5% of Peak Flow)
RTIOR = 2.0

ELEVATION - AREA - CAPACITY RELATIONSHIPS

From USGS 7.5 min. Quad, Penn DER files and Field Inspection Data

At Elevation 1155.0Initial Storage 1800 Acre FeetPond Surface Area 38.4 AcresAt Elevation 1180 Area = 66 Acres

From Conic Method of Reservoir Volume
Flood Hydrograph Package (HEC-1)
Dam Safety Version (user's manual)

$$H = \frac{3V}{A} = \frac{3(1800)}{38.4} = 140.6 \text{ feet}$$

Elevation Where Area Equals Zero

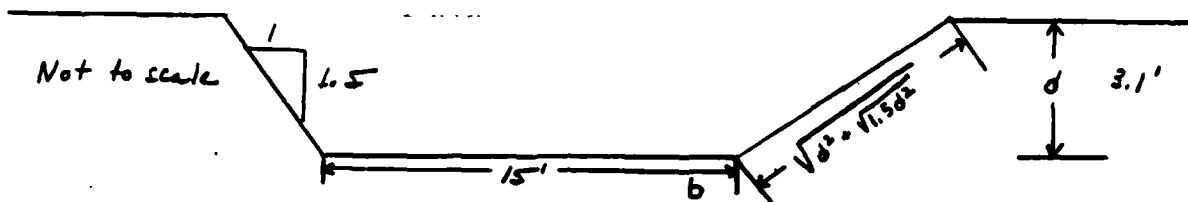
$$1155.0 - 140.6 = 1014.4$$

SA	Area	0.0	38.4	66
SE	Elevation	1014.4	1155	1180

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Job Return Settling Basin Job No. 79153 Y
Subject Trapezoidal Channel Rating Curve
Made By JPH Date 7-8-80 Checked JLZ Date 7-8-80

Trapezoidal Channel Rating Curve



$$Q = VA = \frac{1.486 A}{n} r^{\frac{2}{3}} s^{\frac{1}{2}}$$

$$n = 0.09$$

$$\text{Approach slope} = 0.03' / \text{ft.}$$

30' wide Control section

$$\text{Discharge slope} = 0.03' / \text{ft.}$$

$$\text{Channel slope} = 0.0982' / \text{ft.}$$

$$R = \frac{A}{W_p}$$

$$A = db + d(1.5d)$$

For D = 1'

$$A = db + d(1.5d) = 15(1) + 1(1.5) = 16.5 \text{ ft.}^2$$

$$W_p = b + 2 \sqrt{d^2 + (1.5d)^2} = 15 + 2 \sqrt{(1)^2 + [1.5(1)]^2} = 18.6$$

$$R = \frac{16.5}{18.6} = 0.89$$

$$Q = \frac{1.486(16.5)}{0.09} (0.89)^{\frac{2}{3}} (0.03)^{\frac{1}{2}} = 42.6$$

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Job Refuse Settling Basin Job No. 79153 Y
Subject Trapezoidal Channel Rating Curve
Made By JPH Date 7-8-86 Checked ABZ Date 7-80-80

For D = 2'

$$A = db + d(1.5d) = 15(2) + 2(1.5)(2) = 36$$

$$w_p = b + 2\sqrt{d^2 + (1.5d)^2} = 15 + 2\sqrt{(2)^2 + (3)^2} = 22.2$$

$$R = \frac{A}{w_p} = \frac{36}{22.2} = 1.62$$

$$Q = \frac{1.486(36)}{.09} (1.62)^{\frac{2}{3}} (.02)^{\frac{1}{2}} = 142.0$$

For D = 3'

$$A = db + d(1.5d) = 15(3) + 3(1.5)3 = 58.5$$

$$w_p = b + 2\sqrt{d^2 + (1.5d)^2} = 15 + 2\sqrt{(3)^2 + (4.5)^2} = 25.8$$

$$R = \frac{A}{w_p} = \frac{58.5}{25.8} = 2.27$$

$$Q = \frac{1.486(58.5)}{.09} (2.27)^{\frac{2}{3}} (.03)^{\frac{1}{2}} = 289.0$$

For D = 4'

$$A = 4(15) + 4(1.5)(4) = 84$$

$$w_p = 15 + 2\sqrt{(4)^2 + [(1.5)(4)]^2} = 29.4$$

$$R = \frac{A}{w_p} = \frac{84}{29.4} = 2.86$$

$$Q = \frac{1.486(84)}{.09} (2.86)^{\frac{2}{3}} (.03)^{\frac{1}{2}} = 484$$

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(412) 531-7111

Sheet 2 of 3

Job Return Settling Basin Job No. 79153Y

Subject Trapezoidal Channel Rating Curve

Made By JPH Date 7-8-80 Checked Jaz Date 7-8-80

Elevation

Q

1155.0

0

1156.0

43.6

1157.0

142.0

1158.0

289.0

1159.0

484.0

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Sheet _____ of _____

Job Refuse Settling Basin Job No. 79153Y

Subject Data Input

Made By JPH Date 7-8-80 Checked _____ Date _____

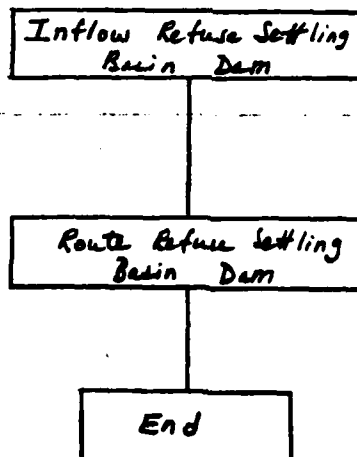
OVERTOP PARAMETERS

Top of Dam Elevation (minimum) = 1158.1

Length of Dam (Excluding Spillway) = 3748

Coefficient of Discharge = 3.08

PROGRAM SCHEDULE



 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

1	A1	NATIONAL PROGRAM FOR THE INSPECTION OF NON FEDERAL DAMS									
2	A2	HYDROLOGIC AND HYDRAULIC ANALYSIS OF REFUSE SETTLING BASIN									
3	A3	PROBABLE MAXIMUM FLOOD PMF/UNIT HYDROGRAPH BY SNYDER'S METHOD									
4	B	300	0	10	0	0	0	0	0	-4	0
5	B1	5									
6	J	1	2	1							
7	J1	1.	.5								
8	K	0	1					1			
9	K1	INFLOW HYDROGRAPH FOR REFUSE SETTLING BASIN									
10	M	1	1	0.17	0.17					1	
11	P		24.2	102	120	130	140				
12	T							1.0	.05		
13	W	0.7	0.5								
14	X	-1.5	-0.05	2.0							
15	K	1	2					1			
16	K1	ROUTING AT REFUSE SETTLING BASIN									
17	Y			1	1						
18	Y1	1						1800	-1		
19	Y4	1155.	1156.	1157.	1158.	1159.					
20	Y5	0.	43.6	143.9	289.	484.					
21	\$A	0.	38.4	66.							
22	\$E1014.4		1155.	1180.							
23	\$S 1155.										
24	\$D1158.1		3.08	1.5	3748.						
25	K	99									
26	A										
27	A										
28	A										
29	A										
30	A										

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
END OF NETWORK	

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE: 8 SEP 80
 RUN TIME: 12.28.22

NATIONAL PROGRAM FOR THE INSPECTION OF NON FEDERAL DAMS
 HYDROLOGIC AND HYDRAULIC ANALYSIS OF REFUSE SETTLING BASIN
 PROBABLE MAXIMUM FLOOD PMF/UNIT HYDROGRAPH BY SNYDER'S METHOD

JOB SPECIFICATION									
NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	10	0	0	0	0	0	-4	0
JOPER				NWT	LROPT	TRACE			
				5	0	0	0		

MULTI-PLAN ANALYSES TO BE PERFORMED

NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS=	1.00	0.50					
*****	*****	*****	*****	*****	*****	*****	*****

INFLOW HYDROGRAPH FOR REFUSE SETTLING BASIN

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO
1 0 0 0 0 0 1 0 0

HYDROGRAPH DATA
IHYDG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
1 1 0.17 0.0 0.17 0.0 0.0 0 1 0

PRECIP DATA
SPFE PMS R6 R12 R24 R48 R72 R96
0.0 24.20 102.00 120.00 130.00 140.00 0.0 0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.800

LOSS DATA
LROPT STRKR DLTKR RTIOL ERAIN STNKS RTICK STRTL CNSTL ALSMX RTIMP
0 0.0 0.0 1.00 0.0 0.0 1.00 1.00 0.05 0.0 0.0

UNIT HYDROGRAPH DATA
TP= 0.70 CP=0.50 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -0.05 RTIOR= 2.00
UNIT HYDROGRAPH 33 END-OF-PERIOD ORDINATES, LAG= 0.70 HOURS, CP= 0.50 VOL= 1.00
8. 28. 53. 73. 77. 69. 58. 48. 40. 34.
28. 24. 20. 16. 14. 12. 10. 8. 7. 6.
5. 4. 3. 3. 2. 2. 2. 1. 1. 1.
1. 1. 1.

0
MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q
SUM 27.10 24.68 2.42 16212.
(688.)(627.)(61.)(459.07)

HYDROGRAPH ROUTING

ROUTING AT REFUSE SETTLING BASIN

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO
2 1 0 0 0 0 1 0 0
ROUTING DATA
CLOSS CLOSS AVG IRES ISAME IOPT IPMP LSTR
0.0 0.0 0.0 1 1 0 0 0
NSTPS NSTDL LAG AMSKK X TSK STORA ISPRAT
1 0 0 0.0 0.0 0.0 1800. -1

STAGE 1155.00 1156.00 1157.00 1158.00 1159.00
FLOW 0.0 43.60 143.90 289.00 484.00
SURFACE AREA= 0. 38. 66.
CAPACITY= 0. 1800. 3089.
ELEVATION= 1014. 1155. 1180.

CNEL SPWID COQW EXPW ELEV COQL CAREA EXPL
1155.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

DAM DATA
TOPEL COQD EXPD DAMMID
1158.1 3.1 1.5 3748.

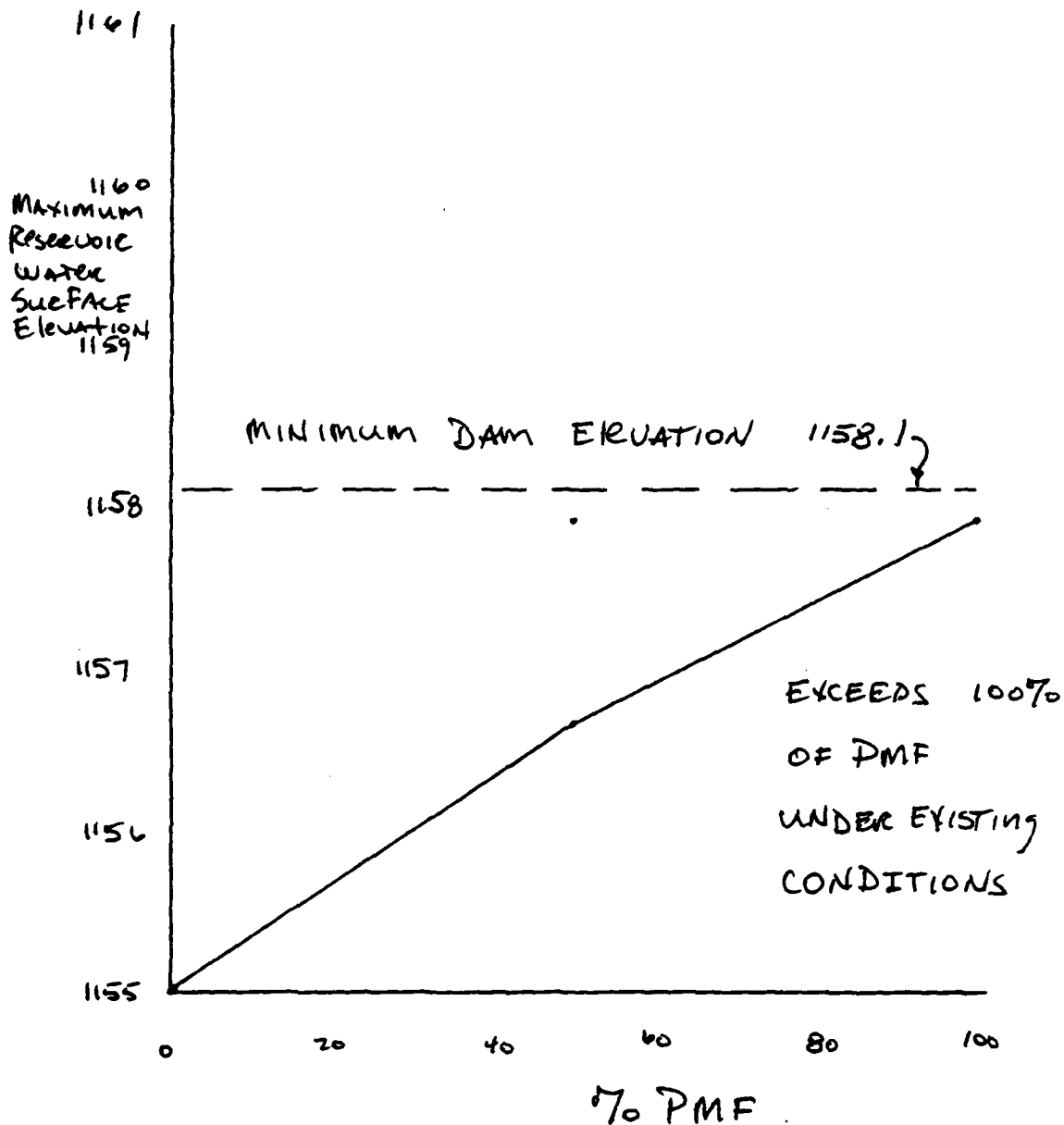
PEAK OUTFLOW IS 278. AT TIME 42.33 HOURS
PEAK OUTFLOW IS 112. AT TIME 42.67 HOURS

1 OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS	
				RATIO 1 1.00	RATIO 2 0.50
HYDROGRAPH AT	1	0.17	1	640.	320.
	(0.44)	(18.13)(9.07)(
ROUTED TO	2	0.17	1	278.	112.
	(0.44)	(7.87)(3.16)(

PLAN 1	ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM			
	1155.01	1155.00	1158.10				
	1800.	1800.	1923.				
	0.	0.	309.				
RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1157.92	0.0	1916.	278.	0.0	42.33	0.0
0.50	1156.68	0.0	1866.	112.	0.0	42.67	0.0

ACKENHEIL & ASSOCIATES
GEO Systems, Inc.
1000 Banksville Road
PITTSBURGH, PA. 15216
(412) 531-7111

Job REFUSE SETTLING BASIN Job No. 79153
Subject HYDROLOGIC PERFORMANCE PLOT
Made By JPH Date 9/8/80 Checked _____ Date _____

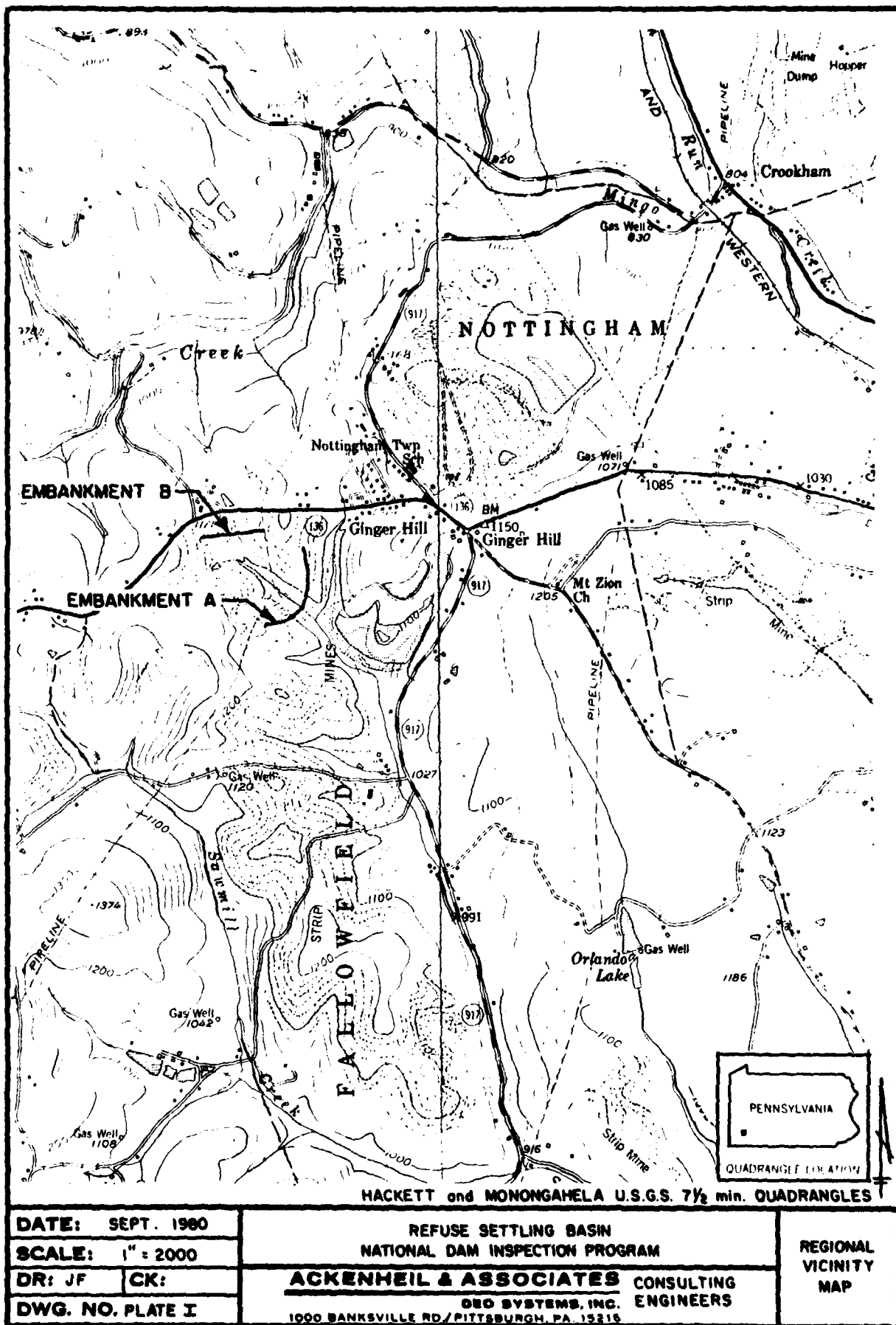


APPENDIX E

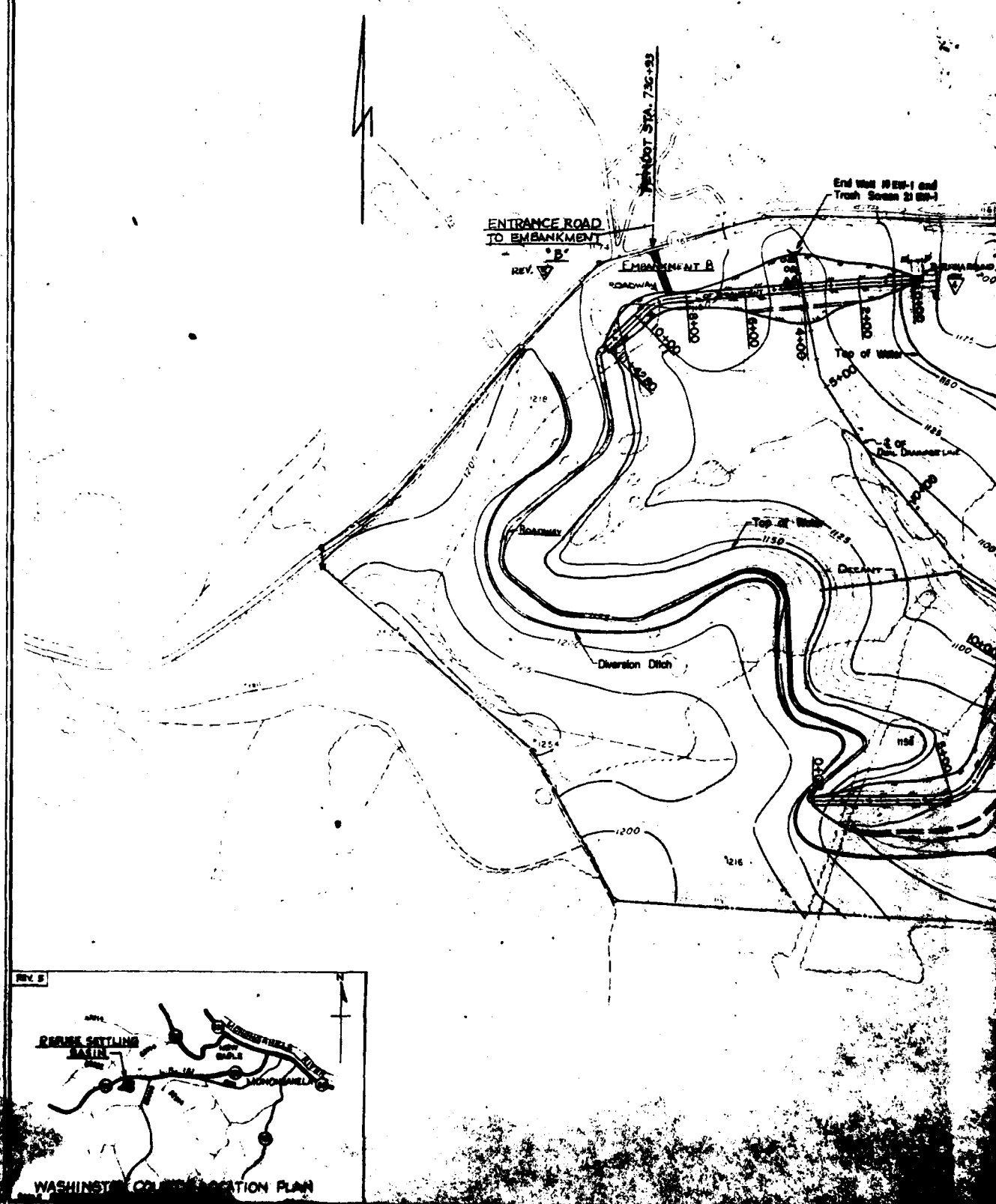
PLATES

LIST OF PLATES

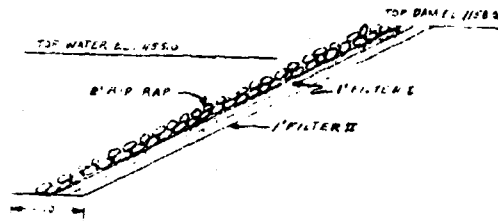
- | | |
|-----------|---|
| Plate I | Regional Vicinity Map. |
| Plate II | Maple Creek Refuse Settling Basin, General Plan. |
| Plate III | Maple Creek Refuse Settling Basin, Typical Embankment Section and Details. |
| Plate IV | Maple Creek Refuse Settling Basin, Spillway-Plan, Profile and Details. Diversion Ditch Details. |
| Plate V | Maple Creek Refuse Settling Basin, Dual 20 inch Drainage Line-Profile and Sections. |
| Plate VI | Maple Creek Refuse Settling Basin, Monitor Details. |
| Plate VII | Maple Creek 3, Earthen Settling Basin, Stability Analysis. |



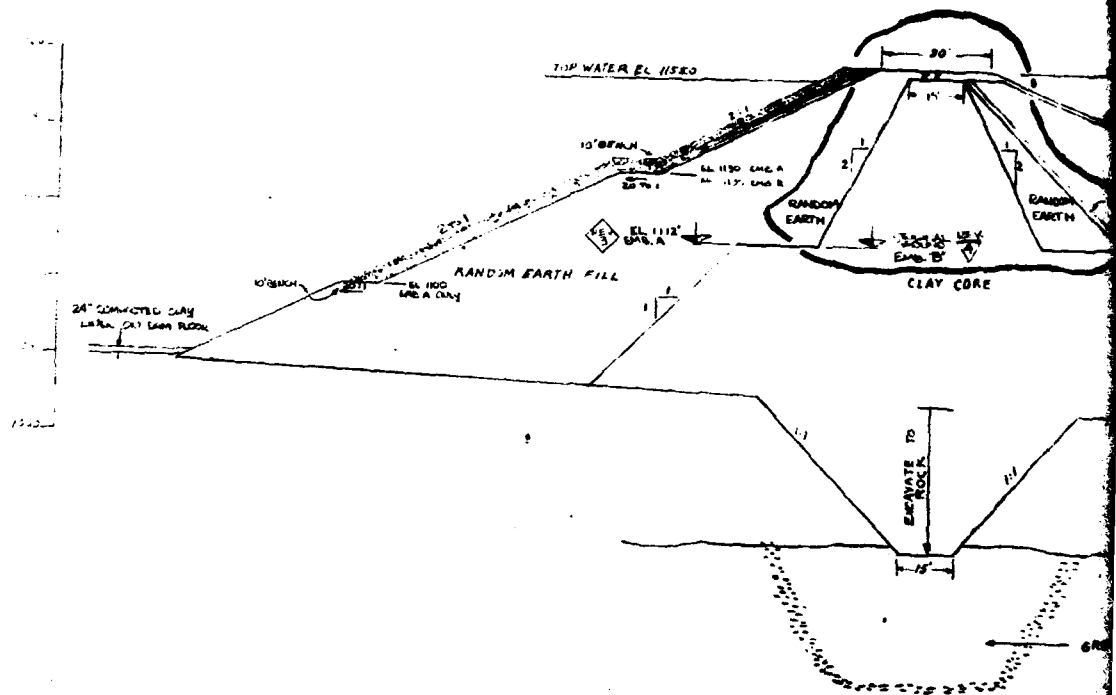
U.S. GOVERNMENT
RECEIVED
APR 20 1974
WASHINGTON, D.C.



U.S. ARMY CORPS
ENGINEERS
RECEIVED
APR 29 1976
CONSTRUCTION DISTRICT



RIP RAP DETAILS
(NOT TO SCALE)



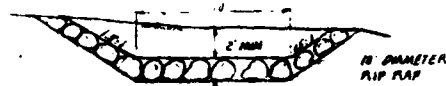
TYPICAL SECTION
7-8



DIT. H SHOULD BE SEED
AS SOON AS POSSIBLE -
VEGETATION WILL PROVIDE
ADEQUATE PROTECTION
AGAINST EROSION

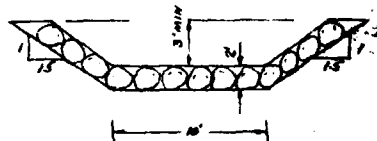


DIVERSION DITCH DETAIL (SCALE 1"=5')
SLOPE = 0.2% OR LESS

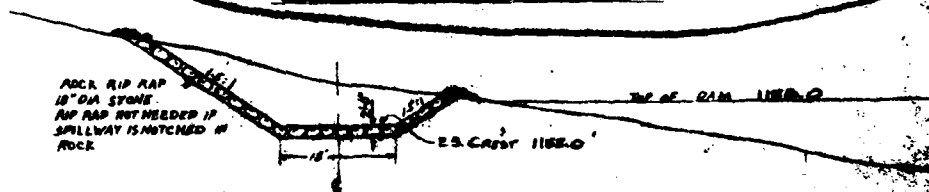
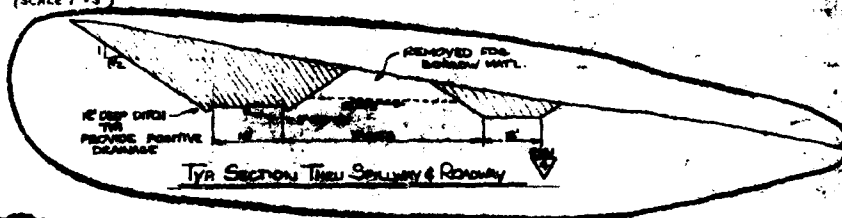


DIVERSION DITCH DETAIL (SCALE 1"=5')
SLOPE 2% TO 12% (MIN)

ROCK RIP RAP 18" DIA
STONE. RIP RAP NOT
NEEDED IF CHANNEL
IS NOTCHED IN ROCK



SPILLWAY EXIT CHANNEL DETAIL (STA 12+52.5 TO 15+85)
(SCALE 1"=5')



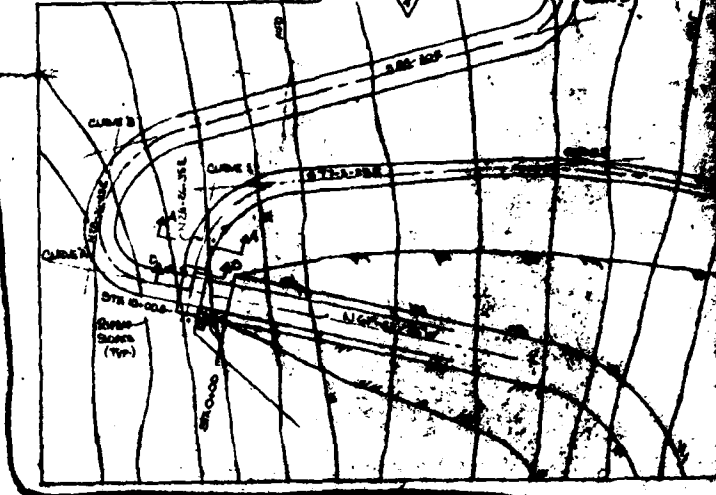
SPILLWAY DETAIL - SECTION A-A (SCALE 1"=10')

EXIT CHANNEL TAPER FROM 15' WIDE AT STA 11+52.32
TO 10' WIDE AT STA 12+52.32

ROADWAY CURVES

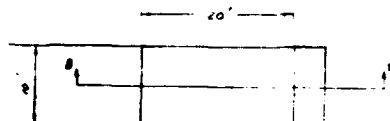
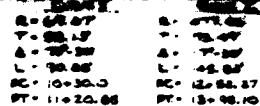
CURVE A	CURVE B
Q = 85.0'	R = 75.0'
T = 35.0'	T = 45'
A = 90°	A = 65° 3' 15"
L = 84.98'	L = 80.73'
PC = 0+58.60	PC = 1+19.58
PT = 1+13.58	PT = 1+94.31

CURVE C
R = 100.0'
A = 90°
L = 62.83'
PC = TO SUIT EXISTING CORNER
ED. C

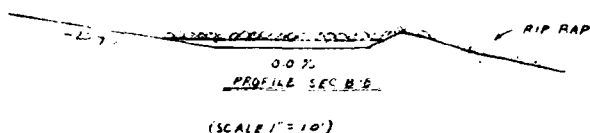


* SPILLWAY ENTRANCE SHOULD BE EXCAVATED
TO APPROXIMATELY 3% GRADE TO ALLOW
FLOW INTO THE CHANNEL SECTION

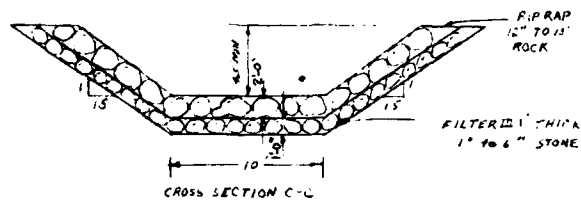
PLAN VIEW - SPILLWAY EXIT CHANNEL



STILLING BASIN PLAN
(SCALE 1" = 10')



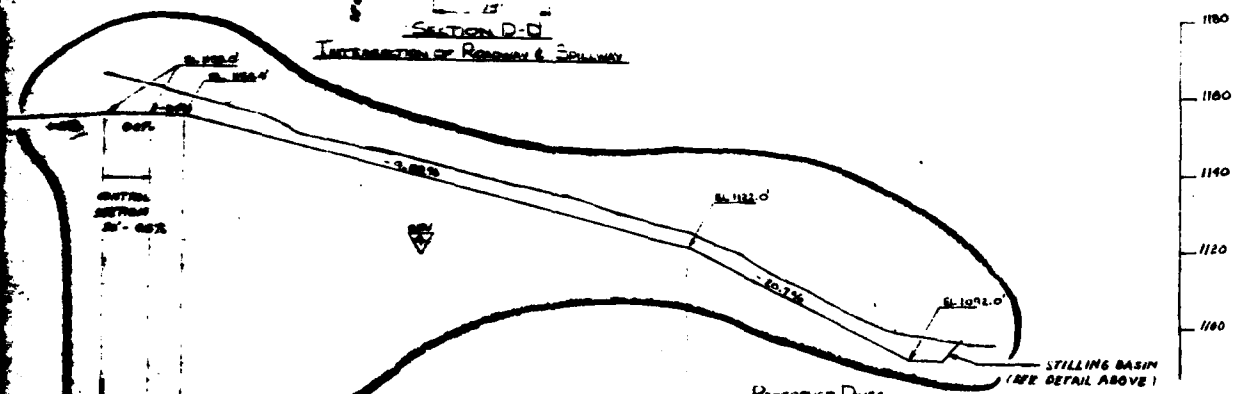
(SCALE 1" = 10')



(SCALE 1" = 5')

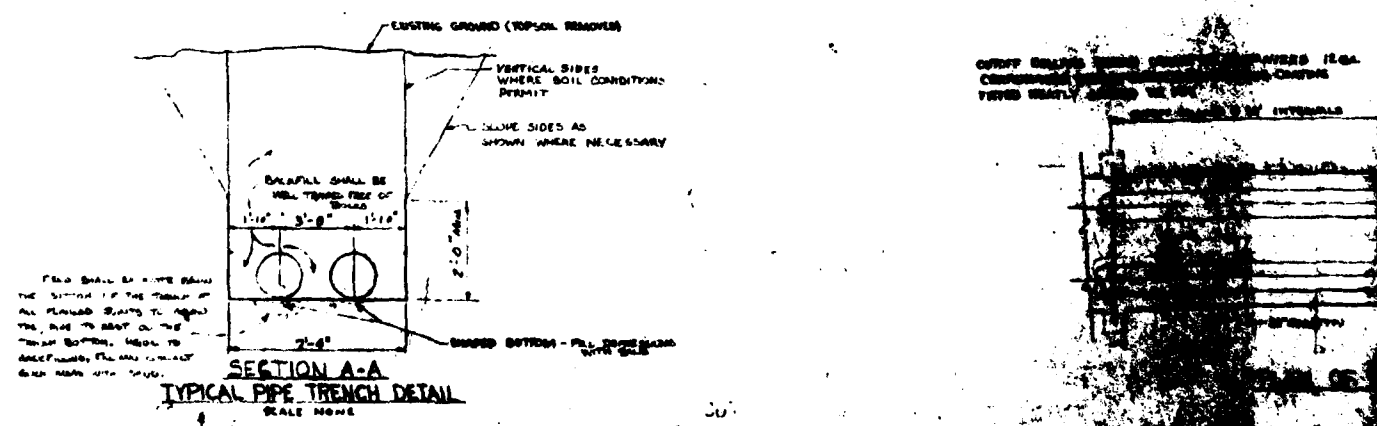
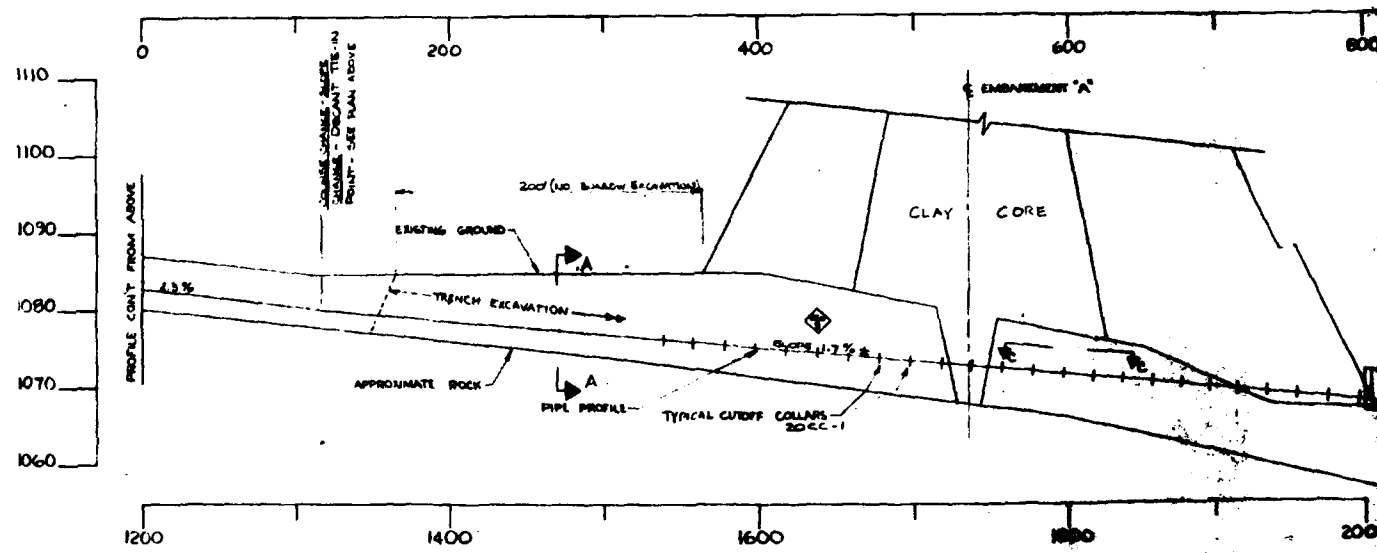
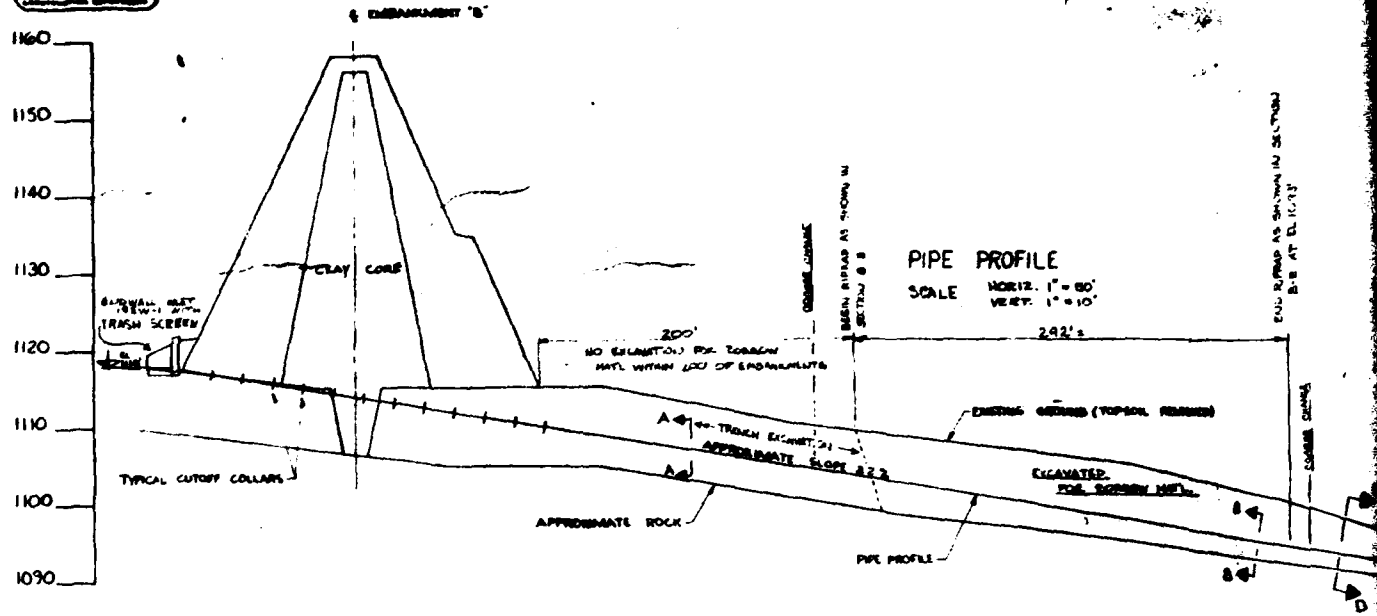


STILLING BASIN DETAIL
STA 15+25 - STA 15+45

Reference Dates

1. ILLINOIS DWS 73-Q-17 SHEET 16 - GEOMETRY OF ROADWAY & DIVERSAL DITCH
2. 6L 20 22 - ROADWAY PROFILE
3. MCFD O&I SHEET 1 - GENERAL PLAN
4. 50 30 3. 2 - GEOMETRY OF ROADWAY AND EMBANKMENTS

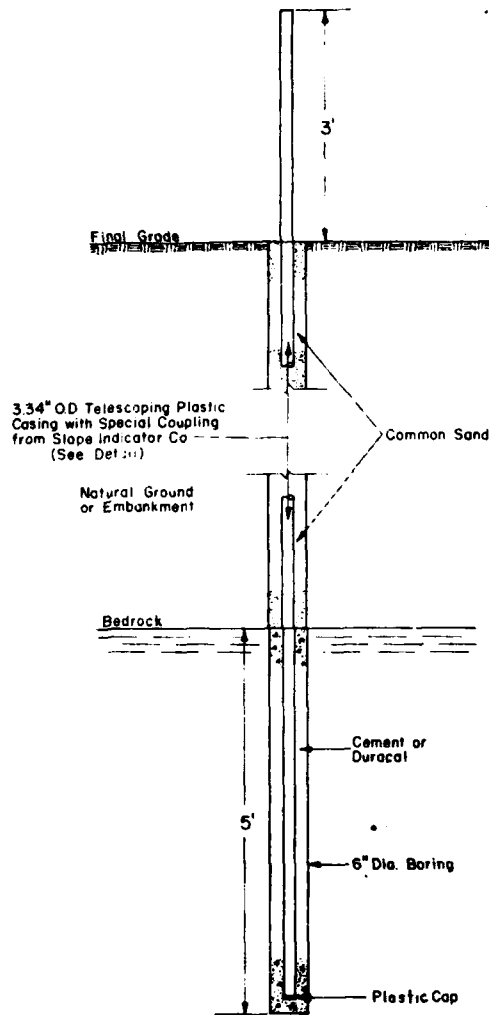
			MAPLE CREEK FOREIGN DWS 041		
			MAPLE CREEK REFUSE, SETTLING BASIN U.S. STEEL CORPORATION		
0-40	EST NOTS	1004 OAL	SPILLWAY - PLAN, PROFILE AND LATERALS DIVISION BITEM DETAILS		
2-5	2-6		L. ROBERT KIMBALL CONSULTING ENGINEERS		
Approved			2-7		
2-8	2-9		ESSENBURG	PENNSYLVANIA	PITTSBURGH
2-10	ADDED STRENGTHENED	2-11			
2-12	ADDED SLOPE AND WALL	2-13			
2-14	ADDED 2-15	AVK			
NOT REVISION			DESIGNED BY <u>2-16</u>	DATE <u>2-17-78</u>	7/3-5201
NOT REVISION			TRACED BY <u>2-18</u>	DATE <u>2-19-78</u>	2-178
NOT REVISION			DESIGNED BY <u>2-20</u>	DATE <u>2-21-78</u>	SCALE AS NOTED
NOT REVISION			APPROVED BY <u>2-22</u>	DATE <u>2-23-78</u>	11



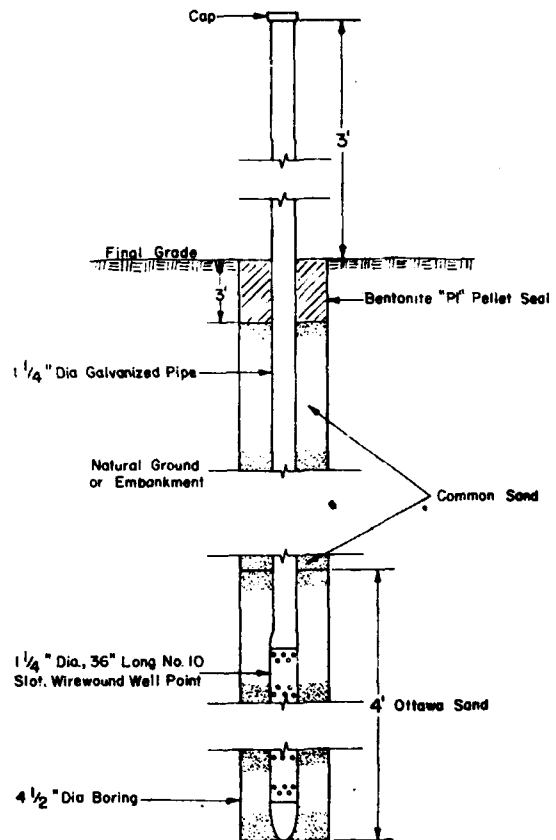




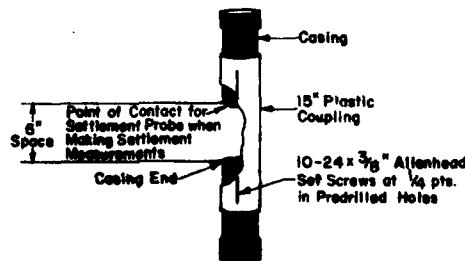
TYPICAL MONITOR WELL



SETTLEMENT GAUGE



OBSERVATION WELL



SETTLEMENT GAUGE
Plastic Casing with Telescoping Plastic Coupling
DETAIL

BILL OF MATERIAL		
ITEM	DESCRIPTION	QTY
SETTLEMENT GAUGE		
1	1/4" DIA. GALVANIZED PIPE	1
2	1/4" DIA. GALVANIZED PIPE	1
3	1/4" DIA. GALVANIZED PIPE	1
4	1/4" DIA. GALVANIZED PIPE	1
5	1/4" DIA. GALVANIZED PIPE	1
6	1/4" DIA. GALVANIZED PIPE	1
7	1/4" DIA. GALVANIZED PIPE	1
8	1/4" DIA. GALVANIZED PIPE	1
9	1/4" DIA. GALVANIZED PIPE	1
10	1/4" DIA. GALVANIZED PIPE	1
11	1/4" DIA. GALVANIZED PIPE	1
12	1/4" DIA. GALVANIZED PIPE	1
13	1/4" DIA. GALVANIZED PIPE	1
14	1/4" DIA. GALVANIZED PIPE	1
15	1/4" DIA. GALVANIZED PIPE	1
16	1/4" DIA. GALVANIZED PIPE	1
17	1/4" DIA. GALVANIZED PIPE	1
18	1/4" DIA. GALVANIZED PIPE	1
19	1/4" DIA. GALVANIZED PIPE	1
20	1/4" DIA. GALVANIZED PIPE	1
21	1/4" DIA. GALVANIZED PIPE	1
22	1/4" DIA. GALVANIZED PIPE	1
23	1/4" DIA. GALVANIZED PIPE	1
24	1/4" DIA. GALVANIZED PIPE	1
25	1/4" DIA. GALVANIZED PIPE	1
26	1/4" DIA. GALVANIZED PIPE	1
27	1/4" DIA. GALVANIZED PIPE	1
28	1/4" DIA. GALVANIZED PIPE	1
29	1/4" DIA. GALVANIZED PIPE	1
30	1/4" DIA. GALVANIZED PIPE	1
31	1/4" DIA. GALVANIZED PIPE	1
32	1/4" DIA. GALVANIZED PIPE	1
33	1/4" DIA. GALVANIZED PIPE	1
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36	1/4" DIA. GALVANIZED PIPE	1
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40	1/4" DIA. GALVANIZED PIPE	1
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44	1/4" DIA. GALVANIZED PIPE	1
45	1/4" DIA. GALVANIZED PIPE	1
46	1/4" DIA. GALVANIZED PIPE	1
47	1/4" DIA. GALVANIZED PIPE	1
48	1/4" DIA. GALVANIZED PIPE	1
49	1/4" DIA. GALVANIZED PIPE	1
50	1/4" DIA. GALVANIZED PIPE	1

AD-A091 257

ACKENHEIL AND ASSOCIATES INC PITTSBURGH PA
NATIONAL DAM INSPECTION PROGRAM. REFUSE SETTLING BASIN (NDI NUM--ETC(U)
SEP 80 DACW31-80-C-0026
NL

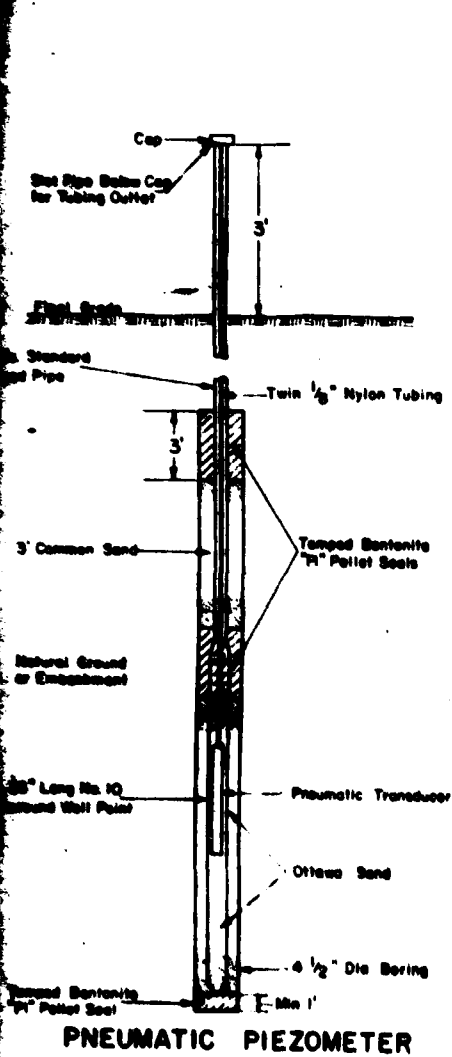
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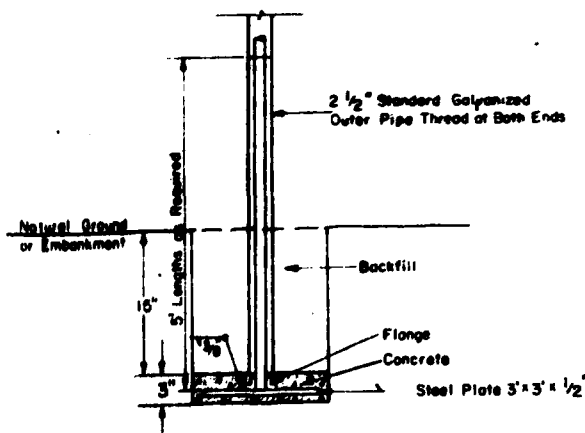
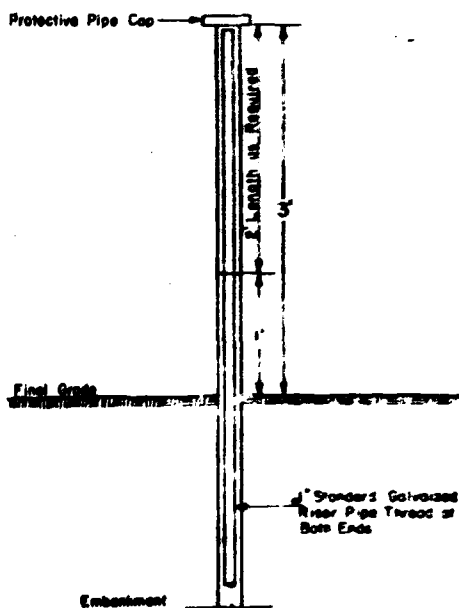


END
DATE
FILMED
4-50
DTIC

WELL PLACEMENTS



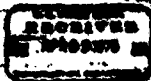
PNEUMATIC PIEZOMETER



SETTLEMENT PLATE

REFERENCE: 1. U.S. GEOLOGICAL SURVEY, BULLETIN 1034, "METHODS OF MEASURING SETTLEMENTS", 1937. 2. U.S. GEOLOGICAL SURVEY, BULLETIN 1034, "METHODS OF MEASURING SETTLEMENTS", 1937. 3. U.S. GEOLOGICAL SURVEY, BULLETIN 1034, "METHODS OF MEASURING SETTLEMENTS", 1937.

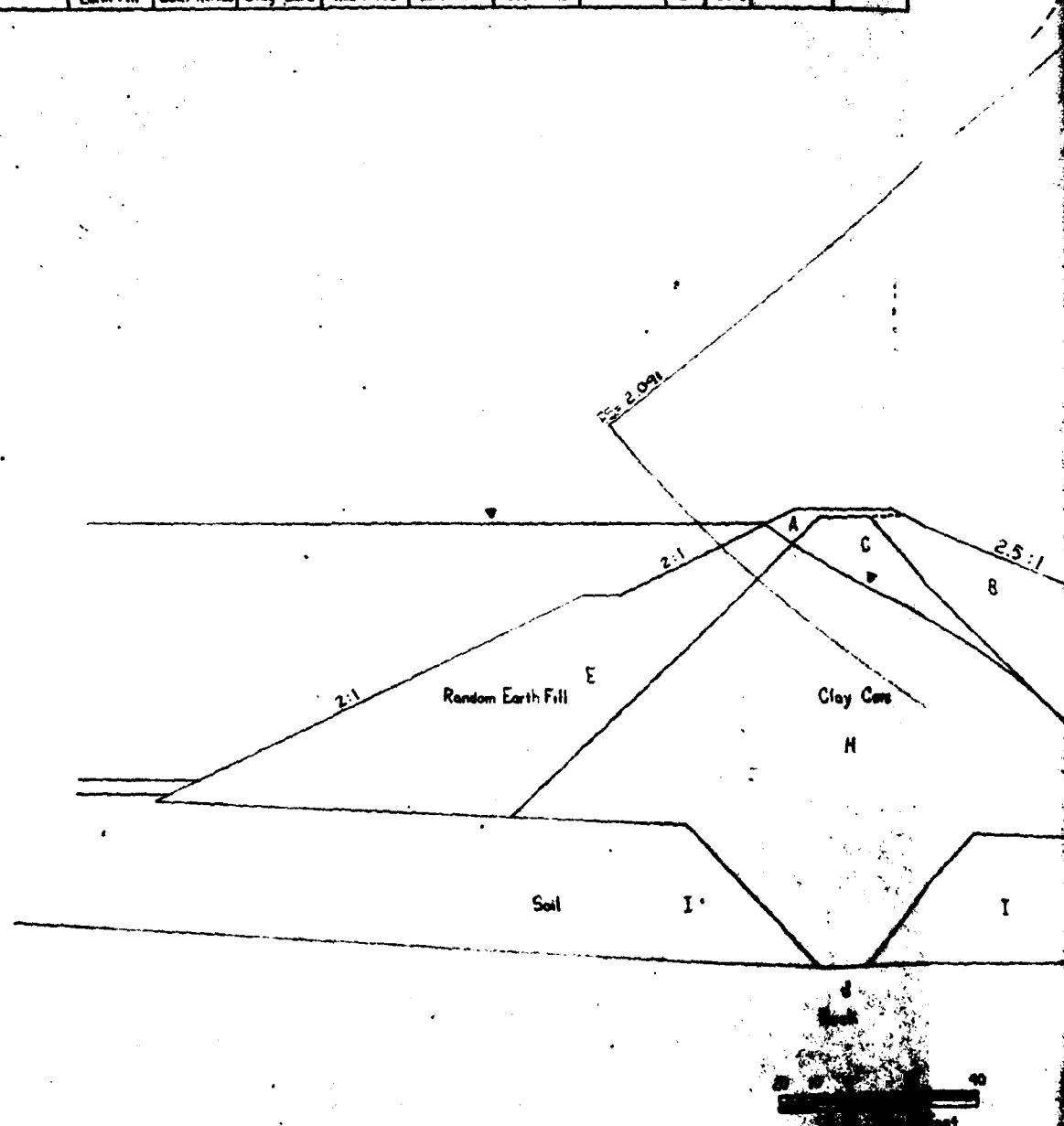
MAPLE CREEK FOREMAN'S DRAWING 001			
MAPLE CREEK REFUSE SETTLING BASIN U.S. Steel Corporation			
MONITOR DETAILS			
L. ROBERT KIMBALL CONSULTING ENGINEER			
SHEPHERD		PITTSBURGH	
DATE	BY	CHKD BY	APP'D BY
7-24-54	SK		
7-24-54	SK		
7-24-54	SK		
7-24-54	SK		



SIMPLIFIED METHOD STATIC CONDITIONS - MAXIMUM SECTION

PARAMETERS										
	A	B	C	D	E	F	G	H	I	J
ϕ (Degrees)	34.3	27.5	27.0	35.0	34.3	27.5	35.0	27.0	32.5	40.0
C (KSF)	0.216	0.288	0.432	0.00	0.216	0.288	0.00	0.432	0.720	0.994
γ (KCF)	0.100	0.100	0.100	0.125	0.108	0.108	0.150	0.108	0.120	0.138
Material	Unsaturated Earth Fill	Unsaturated Coal Refuse	Unsaturated Clay Core	Unsaturated Rock Toe	Saturated Earth Fill	Saturated Coal Refuse	Saturated Rock Toe	Saturated Clay Core	Soil	Rock

1160
1140
1120
1100
1080
1060
1040
1020





MAPLE CREEK FOREIGN DWG. 041	
MAPLE CREEK 3	
EARTHEN SETTLING BASIN	
U.S. STEEL CORPORATION	
STABILITY ANALYSIS	
L. ROBERT KIMBALL	
DESIGNED BY	
CHECKED BY	
DATE	
SCALE	
SHEET NO.	
TOTAL SHEETS	
PLATE VII	

APPENDIX F

GEOLOGY

GEOLOGY

Geomorphology

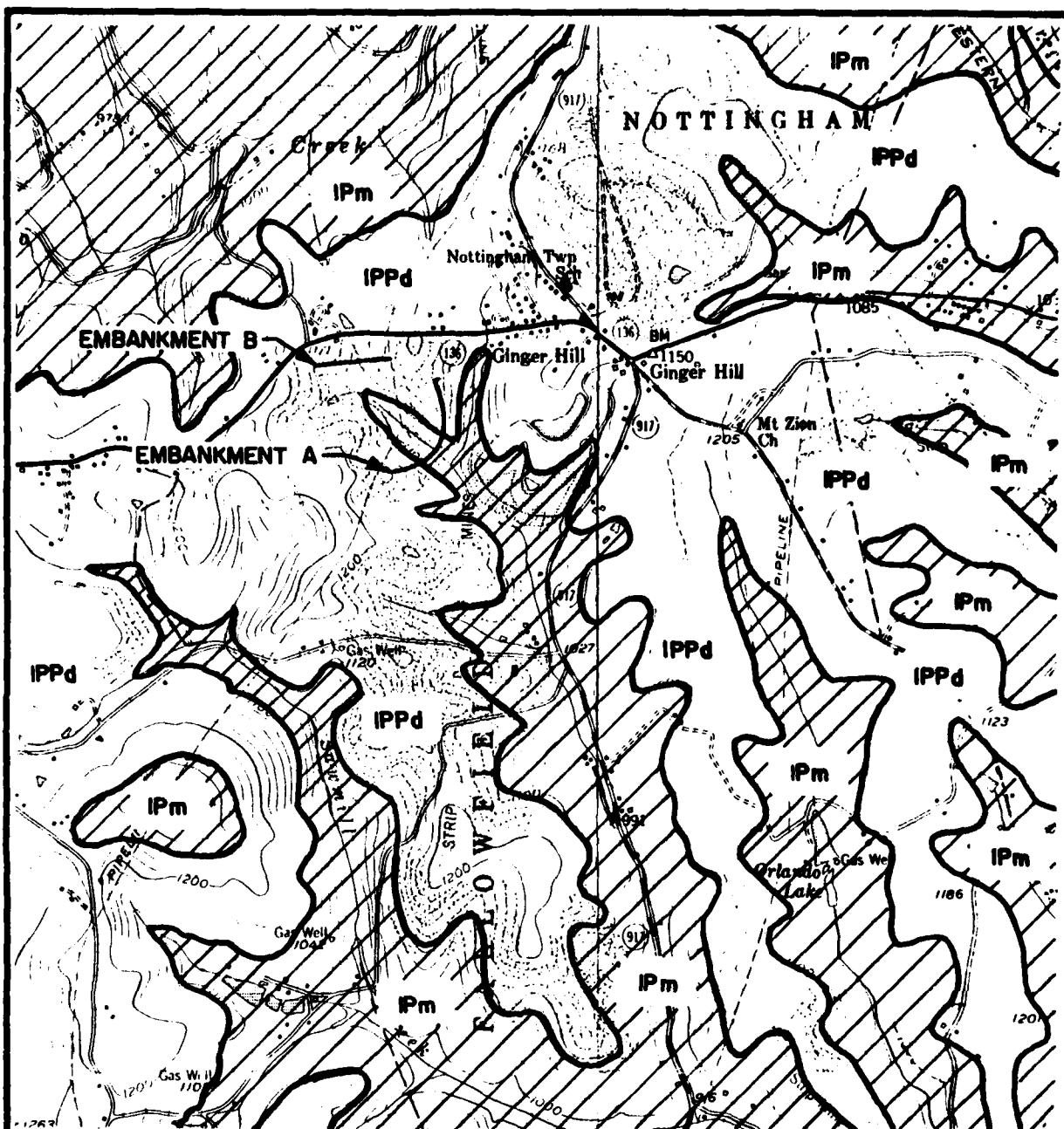
The Refuse Settling Basin is located within the Pittsburgh Plateau section of the Appalachian Plateau Physiographic Province. This area is characterized by essentially flat lying sedimentary rocks which have been deeply cut by streams to form steep sided valleys. The Refuse Settling Basin dams are located at the head of an unnamed tributary of Sawmill Creek. The valley bottom of the unnamed tributary is about 200 feet below the adjacent ridges. The rounded hilltops of these ridges are at Elevation 1200 to 1300 feet, and in a regional sense are part of a broad, undulating plateau.

Stratigraphy

General: The Refuse Settling Basin is located along the stratigraphic boundary of the Monongahela Group of Pennsylvania Age and the Dunkard Group of Permian Age. The Waynesburg Coal Seam, which marks the stratigraphic boundary between these two groups, outcrops at the site.

Mining Activity: The Waynesburg Coal Seam has been strip mined extensively in this area. The Pittsburgh Coal Seam, located about 300 feet below the dams, has been extensively deep mined.

Rock Types: Bedrock, which immediately underlies the site, consists of sandstones and shales.



HACKETT QUADRANGLE, WASHINGTON COUNTY, PENNSYLVANIA

SCALE: 0 1/2 MILE 1:24000
 CONTOUR INTERVAL 20 FT. DATUM IS MEAN SEA LEVEL
 ——— FORMATION CONTACT

DATA OBTAINED FROM PENNSYLVANIA TOPOGRAPHIC AND GEOLOGIC SURVEY GREATER PITTSBURGH REGION GEOLOGIC MAP AND CROSS SECTIONS, 1975 and GREATER PITTSBURGH REGION STRUCTURE CONTOUR MAP, 1975

DATE: SEPT. 1980		REFUSE SETTLING BASIN NATIONAL DAM INSPECTION PROGRAM	GEOLOGIC MAP
SCALE: 1" = 2000'			
DR: JF	CK:	ACKENHEIL & ASSOCIATES CONSULTING GEO SYSTEMS, INC. 1000 BANKSVILLE RD./PITTSBURGH, PA. 15216	

